2018

U.S. STEM workforce views of outstanding leadership: a correlation study

Deborah Doel-Hammond

Pepperdine University

Graduate School of Education and Psychology

U.S. STEM WORKFORCE VIEWS OF OUTSTANDING LEADERSHIP: A CORRELATIONAL STUDY

A dissertation submitted in partial satisfaction

of the requirements for the degree of

Doctor of Education in Organizational Leadership

by

Deborah Doel-Hammond

June, 2018

June Schmieder-Ramirez, Ph.D. - Dissertation Chairperson

This dissertation, written by

Deb Doel-Hammond

Under the guidance of a Faculty Committee and approved by its members, submitted to and accepted by the Graduate Faculty in partial fulfillment of the requirements for the degree of

DOCTOR OF EDUCATION

Doctoral Committee:

June Schmieder-Ramirez, Ph.D., Dissertation Chairperson

Jack McManus, Ph.D.

Christie Cooper, Ed.D.

TABLE OF CONTENTS

Page

LIST OF TABLES

Page

LIST OF FIGURES

Page

DEDICATION

To my husband, Tom, who supported me throughout this journey with his relentless encouragement and unselfishness.

ACKNOWLEDGMENTS

To my doctoral committee Dr. June Schmieder-Ramirez, Dr. Jack McManus, and Dr. Christie Cooper–thank you for a fulfilling dissertation journey and for inspiring a global mindset.

To the excellent team at Pepperdine, particularly Christie Dailo, Regina Meister and the writing support team, and Dr. Tom Granoff–thank you for your guidance that brought me through this writing journey.

To my cohort, particularly Amanda, Jeremy, Tanya, and cohort friends–thank you for filling the long nights, weekends, months and years with friendship.

To my many colleagues at the Allen Institute and Boeing who supported me personally and through participation in this study–thank you for your support and time investment.

To Tom Borak of the Colorado BioScience Association and Dr. Roberta Rincon of the Society of Women Engineers–thank you for your support and time investment.

Finally, to the GLOBE project team, particularly Natasha Fox and Dr. Ali Dastmalchian–thank you for your guidance utilizing the team's generous resources.

VITA

Deborah Doel-Hammond

Work

June 2018 to Present
Chief Human Resources Officer, National Renewable Energy Laboratory
Golden, Colorado

August 2014 to May 2018
Senior Director, Human Resources, Allen Institute
Seattle, Washington

March 2007 to August 2014
Senior Human Resources Leader, Laboratory Test
Prev. Boeing Information Technology Human Resources
Prev. Boeing Airplane Programs Human Resources
Seattle, Washington

October 2002 to February 2007
Principal, Scatter Brains International, Inc.
Mukilteo, Washington

October 2001 to September 2002
Assistant Vice President, Human Resources Policy Development and Communication,
Washington Mutual
Seattle, Washington

July 1998 to September 2001
Vice President, Human Resources, Cascade Bank
Everett, Washington

Education

Doctor of Education candidate, Organizational Leadership,
Pepperdine University, Graduate School of Education and Psychology
Los Angeles/Malibu, California

Master of Arts, Organization Management, Strategy and Change focus area
Fielding Graduate University, Santa Barbara, California

Bachelor of Arts, Organization Management, Communication concentration, magna cum laude,
Northwest University, Kirkland, Washington

ABSTRACT

Objective: This study explored views of outstanding leadership among the science, technology, engineering, and mathematics (STEM) professionals working in the United States within the business and industry sector. U.S. STEM occupations are projected to experience 11.1% growth between 2016 and 2026, higher than the projected 7.4% growth for all occupations (U.S. Department of Labor, Bureau of Labor Statistics, 2017a). The U.S. has undertaken aggressive STEM educational reform and recruiting, to ensure the nation's continued prosperity and national security (National Science Board, 2018b; U.S. Department of Education, 2018). A shift in U.S. STEM demographics will present challenges for business leaders, human resources (HR) practitioners, and educators who prepare leaders for the increasingly cross-cultural workplace. *Method*: This correlational study applied the GLOBE leadership scales to explore study participants' views according to gender, age, national origin group, number of years worked in the U.S, and workforce category. *Results:* The five leader attributes rated as most contributing to outstanding leadership were: (a) trustworthy, (b) clear, (c) sincere, (d) inspirational, and (e) diplomatic. There were 64 statistically significant correlations of low strength and 1 of moderate strength.

Keywords: Business and Industry; Cross-cultural Perspectives; Education; Global Mindset; GLOBE project; Human Resources; Implicit Leadership Theory; Leadership; STEM Education; STEM Policy.

Chapter One: Introduction

Science, technology, engineering, and mathematics (STEM) skills are crucial to global competitiveness, economic prosperity, and national security in the United States (National Science Board, 2018d; Noonan, 2017; STEM Education Act of 2015, 2015; Trump, 2017). The Department of Labor (DoL) projects that jobs within U.S. STEM occupations will experience 11.1% growth between 2016 and 2026, which is higher than the average 7.4% growth projected for all U.S. occupations in total. Jobs within STEM management occupations will experience approximately 9.9% growth (U.S. Department of Labor, Bureau of Labor Statistics, 2018b). Because of educational reform and specialized recruiting efforts (U.S. Congress, 2017; U.S. Department of Education, 2018; U.S. Department of Homeland Security, 2016; White House Office of Science and Technology Policy, 2016), it is anticipated that demographic shifts will occur in the U.S. STEM workforce.

Shifts in the U.S. STEM workforce demographics will result in an increasingly cross-cultural workforce. U.S. STEM leaders will face complex challenges associated with integrating and engaging an increasingly cross-cultural workforce. Each person who enters the workforce brings a different cultural lens that is rooted in personal history. This unique cultural lens influences group processes and norms, as well as ideals of outstanding leadership (Javidan, Sully de Luque, Dorfman, & House, 2006; Nardon & Steers, 2008). In response to both U.S. STEM job growth and anticipated shifts in U.S. STEM demographics, this correlational study explored the views of the U.S. STEM workforce in business and industry to determine which leadership attributes were viewed contributing to outstanding leadership.

Recent History of the Issue

STEM occupations are listed among the fastest growing occupations in the U.S. The average projected job growth for all occupations between 2016 and 2026 is 7.4%, up from 6.5% projected between 2014 and 2024. U.S. Jobs within STEM occupations will grow approximately 11.1% between 2016 and 2026; an increase of approximately 986,400 jobs over 2016 levels. Projections suggest U.S. STEM management occupations will experience job growth of approximately 9.9% for the same period, whereas management jobs in computer and information systems will experience higher growth of approximately 13.7%. Further, projections suggest an average of approximately 761,000 U.S. STEM job openings annually through the year 2026, if accounting for replacement needs (U.S. Department of Labor, Bureau of Labor Statistics, 2015c, 2017a; see Table 1).

Table 1

Department Labor U.S. STEM Employment Projections in Thousands

Occupation	Employed		2016 - 2026		
	2016	2026	Change #	Growth %[a]	Annual openings[b]
Total, all occupations	156,063.8	167,582.3	11,518.6	7.4	18,742.0
Subtotal, all STEM occupations, computed	8,923.9	9,910.3	986.4	11.1	761.0
Total, all management occupations	9,533.1	10,340.4	807.3	8.5	841.5
Subtotal, STEM management occupations, computed	604.4	664.1	59.7	9.9	51.3
Computer and information systems managers	367.6	411.8	44.2	12.0	32.5
Architectural and engineering managers	180.1	190.0	9.9	5.5	13.6
Natural sciences managers	56.7	62.3	5.6	9.9	5.2
Total, all non-management occupations, computed	146,530.7	157,241.9	10,711.3	7.3	17,900.5
Subtotal, STEM non-management occupations, computed	8,319.5	9,246.2	926.6	11.1	709.7
Computer and mathematical occupations	4,419.0	5,026.5	607.5	13.7	366.8
Architecture and engineering occupations	2,601.0	2,795.4	194.3	7.5	210.1
Life, physical, and social science occupations	1,299.5	1,424.3	124.8	9.6	132.8

Note. U.S. STEM occupation growth across all sectors is projected to be higher than growth for all U.S. occupations. Data extracted from "Employment projections: Employment by detailed occupation, 2016 and projected 2026" [Data] by U.S. Department of Labor, Bureau of Labor Statistics (2017, October). No copyright per Title 17 U.S.C., Section 105.4.

[a]Growth represents employment change between 2016 and 2026.

[b]Annual openings represent estimated annual job openings accounting for workers who will leave or retire from the occupation.

Although the justifications are disputed, specialized STEM education and recruiting initiatives have been underway for several years (Carnevale, Smith, & Melton, 2011; National Academy of Sciences, National Academy of Engineering, & Institute of Medicine, 2010; National Science Board, 2018b; U.S. Department of Labor, Bureau of Labor Statistics, 2015d). A new U.S. government administration's strategies, plans, and legislative activities confirm the U.S. government's continued commitment to strengthening U.S. STEM through educational reform and aggressive recruiting (STEM Education Act of 2015, 2015; U.S. Department of Education, 2018; Trump, 2017).

Specialized STEM education and recruiting initiatives will likely shift the demographics of the U.S. STEM workforce. First, there are current initiatives to resolve the underrepresentation of women in STEM education and STEM occupations (U.S. Congress, 2017; Promoting Women in Entrepreneurship Act, 2017). Asians composed approximately 17.4 % of science and engineering jobs in 2013 even though Asians composed only 5.2% of the U.S. population. In contrast, approximately one-half of the U.S. workforce is composed of women, yet depending on the occupation groups examined, only one-quarter of the U.S. STEM workforce is composed of women (National Science Board, 2018e; U.S. Department of Labor, Bureau of Labor Statistics, 2017c). Specialized STEM initiatives show steady progress attracting more girls and women to STEM education and occupations (Beede et al., 2011; Colvin, Lyden, & León de la Barra, 2013; Diekman, Belanger, & Weisgram, 2015; Modi, Schoenberg, & Salmond, 2012; National Girls Collaborative Project, 2017).

Second, there is a sustained emphasis on recruiting Kindergarten-12 (K-12) and college students to STEM study in STEM occupations. Estimates suggested that between 2014 and 2024, approximately one million more STEM graduates would be required than the U.S. would

produce (U.S. Department of Labor, Bureau of Labor Statistics, 2015d). While many college students study in STEM fields, a concerning number of STEM graduates select non-STEM occupations after graduation (U.S. Census Bureau, 2014; U.S. Department of Labor, Bureau of Labor Statistics, 2015d). The U.S. government published an aggressive 5-year strategic plan to address the availability of STEM skills to meet future demands (Executive Office of the President of the United States, 2013). The 2016 and 2017 federal budgets invested approximately $3 billion in STEM education (White House Office of Science and Technology Policy, 2015, 2016). Preliminary examination of the recently signed 2018 federal budget estimated an increase of 13% or $177 billion in U.S. STEM investment over 2017 levels (Hourihan & Parkes, 2018).

Third, U.S. reliance on foreign-born workers to fill STEM jobs is well documented (Information Technology Industry Council, Partnership for a New American Economy, & U.S. Chamber of Commerce, 2012; Mosisa, 2002). Foreign-born employment levels evidence year over year increases that are projected to continue (U.S. Department of Labor, Bureau of Labor Statistics, 2008, 2009, 2010a, 2011, 2012a, 2012b, 2013, 2014, 2015b, 2016a, 2017b). In 2016, the total workforce in the U.S. was composed of approximately 8.0% foreign-born STEM workers, up from 7.7% in 2015, exceeding pre-financial crisis levels in 2007. The 2017 report of 2016 U.S. STEM employment levels evidence that foreign-born workers held approximately 22.8% of U.S. STEM jobs, up from approximately 22.0% in 2015 (U.S. Department of Labor, Bureau of Labor Statistics, 2016a, 2017b).

Statement of the Problem

Specialized initiatives are attracting more women, generations, and foreign-born workers to U.S. STEM occupations (STEM Education Act of 2015, 2015; U.S. Congress, 2017; U.S. Department of Homeland Security, 2016; White House Office of Science and Technology Policy,

2016). Should these initiatives continue to be aggressive and well-resourced, it is reasonable to anticipate an increasingly cross-cultural U.S. STEM workforce. As a workforce grows more culturally diverse, workforce challenges grow complex. Leaders must possess the ability to synthesize diverse perspectives (Bird & Mendenhall, 2016). A problem exists in that leaders will face complex challenges associated with integrating and engaging an increasingly cross-cultural workforce (Javidan et al., 2006; Society for Human Resource Management [SHRM] Foundation, 2015). Implicit leadership theories arise from personal histories. Factors such as gender, generation, and societal culture affect views of leadership effectiveness. To be perceived as a leader, perceived as an effective leader, and be given opportunities to lead necessitates exhibition of attributes that conform to individual paradigms (Lord & Emrich, 2000; Lord & Maher, 1991).

The literature evidences sustained emphasis on STEM policy, education, and advocacy centered on a robust supply of STEM skills to ensure America's continued global competitiveness and national security (National Academy of Sciences et al., 2010; National Academies Committee on Prospering in the Global Economy of the 21st Century, 2005; STEM Education Act of 2015, 2015; U.S. Congress, 1997; U.S. Department of Education, 2018). STEM education has evolved beyond its original emphasis on technical skills, instead now emphasizing interdependencies among the STEM disciplines (Committee on Integrated STEM Education, National Academy of Engineering, & National Research Council, 2014) and newer efforts focus on various aspects of leadership (Blackwell, Katzen, Patel, Sun, & Emenike, 2017). STEM education increasingly emphasizes the importance of establishing a workplace that features individuals from different cultural backgrounds (National Research Council of the National Academies, 2014).

A problem exists in that there is an insufficient emphasis on people-centered leadership skills as important factors in U.S. STEM's overall success. People-centered leadership requires an entirely different set of attributes focused on leading individuals and teams, as well as driving long-term strategic results (Hartmann & Jahren, 2015; McAlpine, 2016; Patterson, 2015). There is a proven connection between how an organization manages its people and the organization's economic results: as high as 40% (Pfeffer, 2007). Leaders help create and facilitate teams that collaborate and innovate (Bennis & Biederman, 1997; von Krogh, Nonaka, & Rechsteiner, 2012).

An opportunity exists to place greater emphasis on leadership within U.S. STEM. Further empirical research is required to explore views of outstanding leadership behaviors and characteristics within the U.S. STEM workforce in business and industry, to understand which leadership attributes may be viewed as contributing to outstanding leadership, resulting in increased collaboration and innovation.

Statement of the Purpose

The first purpose of this empirical, quantitative study was to understand which leadership attributes may be endorsed as either inhibiting or contributing to outstanding leadership among the U.S. STEM workforce in business and industry. The second purpose of this study was to identify what relationships exist, if any, between views of outstanding leadership and gender, age, national origin group, number of years worked in U.S., and workforce category.

Applying the GLOBE Research Survey Form Beta, sections two and four (see APPENDIX A), this quantitative study measured the degree to which study participants viewed each of 112 leadership attributes as either inhibiting or contributing to outstanding leadership. Cross-sectional data were collected via a 7-point Likert-type survey.

Theoretical Framework

This study was informed by the GLOBE theoretical model (see APPENDIX B), an evolving framework of the Global Leadership and Organizational Behavior Effectiveness (GLOBE) research program, which is a collaboration of more than 200 scholars and social scientists worldwide. GLOBE commenced in 1994 and has completed three phases to date (House, Dorfman, Javidan, Hanges, & Sully de Luque, 2014). The model is an evolving framework that links culture, leadership, and organizational effectiveness, providing a lens through which to examine the views of the U.S. STEM workforce as one population with a range of cultures possessing a range of views toward leadership (Dickson, BeShears, & Gupta, 2004; Dickson, Castaño, Magomaeva, & Den Hartog, 2012).

The model's leadership elements emerge from *implicit leadership theory* (House, Javidan, Hanges, & Dorfman, 2002). In the context of this study, implicit leadership theories suggest that study participants will differ in their views toward behaviors and characteristics that constitute outstanding leadership. Implicit leadership theories (ILTs) are *schemas* held by individuals and groups such as societies, organization, and even professions. ILTs shape expectations of leaders and leader acceptance (Lord & Emrich, 2000; Lord & Maher, 1991).

The measurement instrument used in this study was the GLOBE Research Survey Form Beta, sections two and four (GLOBE leadership scales; GLOBE Foundation, 2006a; see APPENDIX A). The GLOBE leadership scales were produced and piloted in GLOBE phase one. GLOBE phase two applied the scales to survey more than 17,300 middle managers across 61 countries within three industries. The instrument is composed of 112 scale items consisting of leadership attributes, behaviors, and characteristics (attributes) drawn from a comprehensive survey of leadership literature and concepts (House & Aditya, 1997). The instrument measures a

study participant's values regarding or what should be leadership attributes on a 7-point Likert-type scale that ranges from *greatly inhibits* to *greatly contributes to* outstanding leadership.

Recent Statistics

The first two phases of GLOBE produced findings that are relevant to this study. Twenty-two of 112 leadership attributes were identified as universally positive. These behaviors achieved world grand means ratings of 6.0 or greater on a 7-point scale and average societal scores of 5.0 or greater in 95% of the surveyed societies. Eight leadership attributes of 112 were identified as universally negative. These attributes received world grand means ratings of less than 3.0 on a 7-point scale and average societal scores less than 3.0 in 95% of the surveyed societies. Thirty-five leadership attributes were identified as culturally contingent, which means the degree of endorsement, either positive or negative, varied by society (see APPENDIX C).

Research Questions

1. Which of the 112 leadership attributes are viewed as contributing to outstanding leadership among U.S. STEM workers in business and industry?
2. How are the views of the 112 leadership attributes related to gender?
    a. Null 2. None of the views of the 112 leadership attributes are related to gender.
    b. Alternative 2. At least one of the views of the 112 leadership attributes is related to gender.
3. How are the views of the 112 leadership attributes related to age?
    a. Null 3. None of the views of the 112 leadership attributes are related to age.
    b. Alternative 3. At least one of the views of the 112 leadership attributes is related to age.

4. How are the views of the 112 leadership attributes related to national origin group?
    a. Null 4. None of the views of the 112 leadership attributes are related to national origin group.
    b. Alternative 4. At least one of the views of the 112 leadership attributes is related to national origin group.
5. How are the views of the 112 leadership attributes related to the number of years worked in the United States?
    a. Null 5. None of the views of the 112 leadership attributes are related to the number of years worked in the United States.
    b. Alternative 5. At least one of the views of the 112 leadership attributes is related to the number of years worked in the United States.
6. How are the views of the 112 leadership attributes related to workforce category?
    a. Null 6. None of the views of the 112 leadership attributes are related to workforce category.
    b. Alternative 6. At least one of the views of the 112 leadership attributes is related to workforce category.

Significance of Topic

Innovation in U.S. STEM is critical to America's competitiveness, prosperity, and security (Gonzales & Kuenzi, 2012; National Science Board, 2018d; STEM Education Act of 2015, 2015; Trump, 2017). Leaders integrate and motivate teams, serving as catalysts for innovation (Agbor, 2008). Focus areas in the field of global leadership have evolved through expatriation, intercultural communication, comparative leadership practices across societies, and cross-societal global management (Bird & Mendenhall, 2016).

GLOBE found that specific leadership attributes and characteristics are universally endorsed or culturally contingent across different societies. This study sought to contribute to GLOBE research by applying the 112 leadership scale items across a new population in the United States. Second, this study hoped to inform educators, researchers, and human resources (HR) professionals exploring non-U.S. centric leadership constructs, leadership assessments, and leadership development for the increasingly cross-cultural U.S. STEM workplace. Third, this study intended to raise awareness of the effects of implicit theories of leadership and their potential effects on workplace interventions such as leadership development and leadership evaluation.

Key Definitions

Dependent variable: Views of outstanding leadership. Views of outstanding leadership will refer to study participants' responses when asked the degree to which each of 112 leadership attributes either inhibits or contributes to outstanding leadership (House et al., 2014). These values arise from a study participant's implicit theories of leadership (Lord & Emrich, 2000; Lord & Maher, 1991). Values are evidenced in the congruence between what a person views as both personally and socially desirable. When directed toward behaviors in others, these values have also been likened to ideals (Minkov, 2013). Views of outstanding leadership were collected via a 7-point interval Likert-type scale survey, sections two and four of the GLOBE Research Survey Form Beta (GLOBE Foundation, 2006a; see APPENDIX A).

Independent variables.

Age. Age refers to the study participant's age in years. Age was collected via a discrete, fixed value survey question.

Gender. Gender refers to the study participant's gender, either: (a) female or (b) male. Gender was collected via a dichotomous, single option survey question.

National origin group. National origin refers to the study participant's country of birth, or alternatively affiliation, resulting from ancestry. Study participants selected from a list of countries composed of those countries found in the GLOBE country clusters (House et al., 2014) or Ronen and Shenkar's (2013) country clusters (see APPENDIX D). National origin was translated to a national origin group and collected via a nominal, single-option survey question.

Number of years worked in the U.S. Years worked in the U.S. refers to the total duration of years that a study participant has been employed in the U.S. Years worked in the U.S. was used to infer a U.S. STEM worker's potential degree of U.S. acculturation (Sasaki & Yoshikawa, 2014). Years worked in the U.S. was collected via a discrete, fixed value survey question.

Workforce category. Workforce category refers to the study participant's workforce category: (a) individual contributor without direct reports, (b) first-level manager or supervisor with direct reports, (c) mid-level manager with direct reports, or (d) executive/top-level manager with direct reports. Workforce category was collected via a nominal, single-option survey question.

Key Terminology

- *Acculturation*. Acculturation will refer to the degree of cultural adaptation (Nayar, 2015).
- *Baby Boomers*. Baby Boomers will refer to a U.S. generational cohort born between the years following World War II in 1946 and the early 1960s ("Baby Boomers," 2018).

- *Country clusters*. Country clusters will primarily refer to the GLOBE country clusters, which range in similarity and dissimilarity based on proximity, with opposite clusters representing those cultures that are most dissimilar, and adjacent clusters representing those cultures that are most similar (see APPENDIX E).
- *Cross-cultural*. Cross-cultural will refer to a complex social system that arises when many cultures are present in the workplace.
- *Culture*. This study adopted the definition of culture as "collective programming of the mind" (Hofstede, 1980, p. 13). Mental programming occurs individually or collectively. Culture exists in societies, whereas subcultures exist within groups (Hofstede, 1980).
- *Cultural intelligence*. Cultural intelligence will refer to an individual's ability to function effectively in an intercultural environment (Ang, Van Dyne, & Roskstuhl, 2015; Li, Mobley, & Kelly, 2016).
- *Cultural lens*. Cultural lens will refer to the dynamic that cultural variations result in perceptual differences in the workplace (Hofstede, Hofstede, & Minkov, 2010)
- *Culturally endorsed implicit theories of leadership (CLT)*. CLT will refer to the dynamic that cultural variations result in perceptual differences toward leadership in the workplace. CLT suggests that "leadership can be recognized based on the fit between an observed person's characteristics with the perceiver's implicit ideas of what leaders are" (Den Hartog, House, Hanges, Ruiz-Quintanilla, & Dorfman, 1999, p. 225). Based on an individual's culture, ideals of outstanding leadership will vary.

- *Culture*. Culture will refer to dimensions of cultural variation or mental programming arising from gender, age, ethnicity, national origin, and other factors that distinguish one population of people from another population (Hofstede et al., 2010).
- *Foreign-born*. Foreign-born will refer to workers in the United States who were not citizens of the U.S. upon birth. The population also includes both undocumented and legal immigrants such as refugees, students, and temporary workers (U.S. Department of Labor, Bureau of Labor Statistics, 2014).
- *Generation X*. Generation X will refer to a U.S. generational cohort born between the early 1960s and the early 1980s. ("Generation X," 2018).
- *Generation Y or millennials*. Generation Y or millennials will refer to a U.S. generational cohort born between the early 1980s and the mid-2000s ("Millennials," n.d.).
- *GLOBE*. GLOBE will refer to the Global Leadership and Organizational Behavior effectiveness project, a longitudinal study of culture and leadership initiated by Robert J. House, Ph.D., of the Wharton School at the University of Pennsylvania, in the early 1990s. In partnership with more than 200 researchers from multiple disciplines, GLOBE has surveyed more than 1900 companies in 69 societies (House et al., 2014).
- *Global mindset*. The term global mindset has evolved over a few decades (Estienne, 1997; Gupta & Govindarajan, 2002; Pucik, Tichy, & Barnett, 1992; SHRM Foundation, 2015). This study adopted a simple definition: "an individual's capability to influence others unlike themselves" (Javidan & Bowen, 2013, p. 145).

- *Leadership*. Leadership will refer to acts, attributes or characteristics, of either formal leaders such as managers, or non-managers, which result in "interpersonal influence within groups and organizations" (Eagly & Antonakis, 2015, p. 572).
- *Native-born*. Native-born will refer to individuals born in the U.S., Puerto Rico, or Guam (U.S. Department of Labor, Bureau of Labor Statistics, 2014).
- *Occupation group*. Occupation group will refer to the study participant's occupation group as either: (a) computer, information technology or information sciences occupations (includes technicians, technologists and managers); (b) life sciences, physical sciences or social sciences occupations (includes technicians, technologists and managers; and excludes health occupations); (c) engineering occupations (includes technicians, drafters and managers); or (d) other occupations (includes architecture, health and all other occupations). These occupation groups are adapted from the U.S. Department of Labor's Occupational Outlook Handbook (U.S. Department of Labor, Bureau of Labor Statistics, 2018c). Occupation group was used to qualify potential study participants to participate in this study. Occupation group was collected via a nominal, single-option survey question.
- *Outstanding leaders*. Outstanding leaders will refer to people in an organization or industry who are "exceptionally skilled at motivating, influencing, or enabling you, others or groups to contribute to the success of the organization or a task" (GLOBE Foundation, 2006b, p. 10).
- *Primary work country*. U.S. STEM current primary work country will refer to the study participant's primary work country as either: (a) United States, or (b) other country. Primary work country was used to qualify potential study participants to

participate in this study. Primary work country was collected via a dichotomous, single-option survey question.

- *Primary work sector*. U.S. STEM work sector will refer to the study participant's work sector as either: (a) 2 or 4-year academic institution, (b) government, or (c) business and industry, including for-profit and non-profit organizations. The NSF estimated the population for this study at 5.5 million (National Science Foundation [NSF], 2017). Excluded work sectors were academia and government. Primary work sector was used to qualify potential study participants to participate in this study. Primary work sector was collected via a nominal, single-option survey question.
- *SMET or STEM*. SMET or STEM will refer to educational or occupational domains of science, technology, engineering and mathematics as described in the Standard Occupation Classifications (SOC; U.S. Department of Labor, Bureau of Labor Statistics, 2010b).
- *Universally endorsed and culturally contingent leadership attributes*. Universally endorsed and culturally contingent leadership attributes will refer to distinctions among leadership attributes as universally desirable, universally undesirable, or that the desirability or undesirability is dependent on the societal culture. In GLOBE, 22 leadership attributes were identified as universally positive. There were eight leadership attributes identified as universally negative. There were thirty-five leadership attributes identified as culturally contingent (see APPENDIX C).
- *U.S. STEM workforce*. U.S. STEM workforce will broadly refer to persons working in science, technology, engineering, and mathematics (STEM) occupations or STEM-related occupations within the U.S. Specific to the proposed study, U.S. STEM

workforce will refer to STEM occupations (see APPENDIX L), STEM-related technologist, technician, and management occupations (see APPENDIX M) within the U.S. business and industry sector. Excluded occupations were architecture and health occupations (see APPENDIX N).

Limitations of the Study

This leadership study was limited to individuals working in U.S. STEM and management-related occupations in organizations of varied size and product scope, within the business and industry sector. For this reason, this study's findings are not generalizable to other populations.

The literature review of this study adopted *country clusters* as a framework to contextualize national and societal *culture*. Country clusters have been attempted, debated, and negotiated for more than half a century. Many factors can marginalize across any of these clustering approaches (Gelbard, Carmeli, Bittmann, & Ronen, 2009; House, Hanges, Javidan, Dorfman, & Gupta, 2004; Ronen & Shenkar, 2013). Following a comprehensive review of the methodologies used to develop country clusters and examination of alternative indices (World Values Survey Association, 2014; Yeganeh, 2013), the researcher concluded that country clusters were suitable for the limited exploratory purposes of this exploratory study.

Delimitations

The NSF (2017) recognizes four sectors in its STEM data sets: (a) 2-year college, (b) 4-year college, (c) business and industry, and (d) government. The present study focused on the U.S. STEM population within the business and industry sector for several reasons. First, the business and industry sector represents most of research and development (R&D) activity and performance in the U.S. (National Science Board, 2018c). Second, government and academia

present very different work environments than business and industry. Third, academia has not evidenced STEM skill shortages, but rather surpluses, particularly in life and physical sciences. Fourth, the government is experiencing limited growth and some decline in STEM jobs (U.S. Department of Labor, Bureau of Labor Statistics, 2015d).

This leadership study was limited to five dependent variables that were treated as ordinal and then analyzed using a nonparametric correlational approach as a first step in exploring ideals of leadership in the U.S. STEM workplace. In contrast, cross-cultural studies that isolate numerous variables to determine correlation and causation are highly complex, requiring different research methods than those used in this study.

The educational reform and recruiting efforts that are described in this study also refer to increasing the presence of underrepresented minorities in U.S. STEM. This study excluded variables related to ethnicity and race based on incompatibility with the study's design. This study focused on a limited number of variables that are translatable to ordinal measures.

Key Assumptions

This study presumed that U.S. STEM workers would respond with candor regarding their views of the 112 leadership attributes. This study included both managers and non-managers, adopting the assumption that leadership is a shared responsibility across organizations, rather than the sole responsibility of managers (Alimo-Metcalfe & Alban-Metcalfe, 2012).

This study used datasets originating from the DoL and the National Science Foundation (NSF) for estimating populations and trends. Whereas the DoL dataset is refreshed approximately 5 months following the end of the calendar year, the most recent NSF dataset to date was 2015. Further, the NSF dataset offers a breakdown of 62 occupations in contrast to 184 DoL occupations. Finally, the NSF dataset consolidates technicians and technologists with other

STEM-related occupations that were excluded from this study. The researcher considered these factors and viewed the NSF as the widely used, authoritative data set offering the most flexibility to examine the demographics of this study's population and variables.

The GLOBE leadership scales are a multi-level structure consisting of three levels. The 112 scale items that measure ILTs individually correspond to 21 *primary* leadership dimensions that measure CLTs. The 21 primary leadership dimensions correspond to six global leadership dimensions that measure CLTs (Hanges & Dickson, 2004). Following a comprehensive review of the methodologies used to develop the 112 GLOBE leadership scales (Hanges & Dickson, 2004), and an examination of alternative ILT measurement instruments and their development, the researcher selected the GLOBE 112 scale items as compatible with this study's objectives.

Likert-type scales sometimes invite central tendency. Study participant responses may be influenced by societal values, organizational values, and other personal factors such as education or ethnicity. Views may be compromised based on the perceived social desirability of a rated leader attribute. For this reason, study participants may not have viewed the provided leadership attributes as either favorable or unfavorable, and instead, may have embraced alternative attributes as favorable (House et al., 2002). Similarly, to the extent a study participant was satisfied or dissatisfied with leadership or management in the organization where he/she works, certain leader attributes may have been in focus, and study participants may have been impacted by the effects of marginal preferences (Maseland & van Hoorn, 2009).

Chapter Summary

America's global competitiveness, economic success, and national security depend on America's advantage in STEM (National Science Board, 2018d; STEM Education Act of 2015, 2015; Trump, 2017). Jobs within U.S. STEM occupations will grow an estimated 11.1% between

2016 and 2026, which is higher than the projected 7.4% growth projected for all U.S. occupations. Management jobs within U.S. STEM will experience 9.9% growth (U.S. Department of Labor, Bureau of Labor Statistics, 2015c). Demographic shifts will occur in the U.S. STEM workforce because of educational reform and specialty recruiting efforts. The increasingly cross-cultural U.S. STEM workforce, with differing ideals leadership, will present new challenges for leaders. U.S. STEM leaders who can integrate the increasingly cross-cultural U.S. workforce will complement a robust supply of STEM skills and further America's success in STEM (von Krogh et al., 2012).

Chapter Two: Literature Review

The U.S. government continues to resource aggressive education and recruiting initiatives that are shifting the demographics in U.S. STEM to meet anticipated workforce demands, (Gonzales & Kuenzi, 2012; U.S. Department of Education, Academic Improvement and Teacher Quality Programs, 2015; U.S. Department of Homeland Security, U.S. Citizenship and Immigration Services, 2015b). Anticipated demographic shifts will produce cultural shifts in U.S. STEM. Different cultures vary in their views of leadership effectiveness (House et al., 2014). This literature review examines the history of U.S. STEM, shifting U.S. STEM demographics, and implications for views of outstanding leadership among the U.S. STEM workforce.

Literature review strategies included extensive reviews of government and education literature, research, and data sets. Internet search engines were used to mine for the acronyms SMET and STEM to detect the emergence of the acronyms and surface major themes. Searches across 22 academic databases and news archives adopted a similar approach. Additional literature search strategies included an intensive review of reports published by government-funded entities, business and industry (Cook, Mason, Morse, & Neuhauser, 2015; Finn & Donovan, 2013), and education studies (Carnevale et al., 2011).

This literature review consists of five sections. The first section, Historical Background of U.S. STEM, explores the history and evolution of U.S. STEM, highlighting the period between the mid-1900s through 2016. This first part of this section describes the historical chain of events leading to a continued national focus on STEM. The second part of this section examines STEM demographics.

The second section, GLOBE Theoretical Model, first provides an overview of the GLOBE project (House et al., 2014). Next, this section provides an overview of and context for selection of the GLOBE Theoretical Model (see APPENDIX B) as the theoretical framework for this study. Last, this section provides an overview of and context for selection of the GLOBE leadership scales (see APPENDIX A) as the measurement instrument for this study.

The third section, ILTs, examines this follower-centered leadership theory and the emergence of CLTs arising from societal and organizational culture. More than 35 years of cross-cultural research reveals that societal and organizational culture affect views of leadership effectiveness (Hofstede, 1980; Hofstede et al., 2010; House et al., 2004, 2014).

The fourth section, U.S. STEM Workforce and Implications for Views of Leadership, examines findings in U.S. STEM literature related to this study's independent variables and the implications for views of outstanding leadership. The independent variables that will be examined in this study include: (a) gender, (b) age, (c) national origin group, (d) number of years worked in the U.S., and (e) workforce category.

Historical Background of U.S. STEM

President George Washington's (1790, para. 10-11) first state of the union address to Congress, then called the Annual Message, recognized STEM progress as critical to the advancement of the nation's interests

> The advancement of Agriculture, commerce and Manufactures, by all proper means, will not, I trust, need recommendation. But I cannot forbear intimating to you the expediency of giving effectual encouragement as well to the introduction of new and useful inventions from abroad, as to the exertions of skill and genius in producing them at home;

> and of facilitating the intercourse between the distant parts of our Country by a due attention to the Post-Office and Post Roads.
>
> Nor am I less persuaded, that you will agree with me in opinion, that there is nothing, which can better deserve your patronage, than the promotion of science and literature. Knowledge is in every country the surest basis of public happiness. In one, in which the measures of government receive their impression so immediately from the sense of the community as in our's it is, proportionably essential.

America's first president acknowledged the nation's dependency on other countries' inventions and urged Americans to progress in science (Gonzales & Kuenzi, 2012). Early inventions shaped history. In the nation's early years, Benjamin Franklin successfully experimented with electricity. Joseph Henry discovered electromagnetic induction and invented electric motors and the telegraph (Roach, 2013). Two world wars eventually disrupted the international power bases and America arose as the world economic leader in terms of industrial superiority. During this period, America's relationship with the Union of Soviet Socialist Republics (U.S.S.R.), a World War II ally, evolved into a capitalist rivalry that resulted in a political and military Cold War that lasted through 1991 (Roberts, 2001). Largely based on technological advances during the space age, originating through competition with the U.S.S.R., the interdependencies between science, mathematics, engineering, and technology occupations reached a crescendo.

By the early 1980s, amid the cold war, America faced alarming deficiencies in the U.S. education system. High school students' test scores were declining to 1957 levels. Educator turnover in the U.S. educations system was high and U.S. leadership in science and technology was threatened (Gardner, 1983). After the Cold War, the U.S. government recognized a growing

need to accelerate the nation's progress in science, mathematics, engineering, and technology to maintain competitiveness in the post-Cold War era.

Between 1958 and the mid-1990s, America broke the sound barrier in flight, flew hypersonic research aircraft, launched world communications satellites, walked on the Moon, built a space station, launched a space shuttle program, sent a woman into space, built a space lab, established a military strategic defense initiative, and more ("45 Moments in NASA History," n.d.). These game-changing achievements by the National Aeronautics and Space Administration (NASA), along with industrial achievements, accelerated the interdependencies among science, mathematics, engineering, and technology disciplines. During these years, there was increasing debate whether public education was the responsibility of local communities, states or the federal government (Townley, Schmieder-Ramirez, & Wehmeyer, 2005). In 1993, U.S. government agencies formed the Federal Coordinating Council for Science, Engineering, and Technology (FCCSET). FCCSET undertook a critical assessment of gaps and overlaps in 1991-1992 government-funded science, mathematics, education, and technology (SMET) education programs that were directed toward teacher enhancement, curriculum improvement, and student support. FCCET's report included the illuminating fact that although the government would exceed $22 billion to fund education in 1993, only $2.2 billion was allocated for SMET education (Federal Coordinating Council for Science, 1993).

NASA achieved both advances in space research and societal advancements on Earth (International Space Exploration Coordination Group, 2013). While NASA experienced its achievements, other SMET disciplines experienced equally notable achievements. Charles Marsh and Edward Drinker Hope were leading contributors in the field of paleontology and the discovery of dinosaur fossils. Donald Johanson and Tim White were leading contributors in the

extended field of paleoanthropology with the discoveries and investigations of Lucy and Ardi, several million-year-old hominids that inspired the investigation of connections between apes and humans. Thomas Hunt Morgan's lab and ultimately Craig Venter's Celera team were pioneers in human genomics. Additionally, the U.S. government partnered with private industry to introduce the commercial internet across the world in 1994 (Roach, 2013).

The internet's commercialization in 1994 was a game changer for STEM in the U.S. and across the world. By 1995, the internet had 16 million users and it continued to grow exponentially year over year (Caillaiu & Connolly, 2000). Advances in computing and information technology were surging and driving changes in the makeup of the U.S. workforce. There was a widening gap between skilled and unskilled workers' wages, which suggested U.S. economic impacts. Wages rose at a pace that left many employers with a strange dilemma whether to adjust wage structures upwards or deskill jobs (Cappelli, 1996). At Stanford University, Barr and Tessler (1996) framed discussions around an emerging shortage of computing and information technology workers resulting from the unprecedented growth in the computing industry.

Up to this point, when technical education was examined, the literature referenced science and mathematics education, or science and engineering education. As technology began to accelerate and differentiate as a discipline, it became more common to observe references to science and technology in the literature. The acronym SMET appeared with increasing frequency, to succinctly reference skills and education across four distinct disciplines of science, mathematics, engineering, and technology.

In April 1995, the National Research Council (NRC) and the NSF cosponsored a convocation and declared *The Year of National Dialogue* regarding SMET. The fundamental

recommendation that emerged from the convocation was that “All students should have access to supportive, excellent programs in science, mathematics, engineering, and technology, and all students should acquire literacy in these subjects by direct experience with the methods and processes of inquiry” (National Research Council, 1996, p. 4).

The convocation articulated that particular factors inhibited the effectiveness of SMET education and threatened America’s global leadership in science and technology. The first factor that inhibited the effectiveness of SMET education efforts was deficient teaching methods. It was determined that even in some of America’s most prestigious universities, undergraduate students received 6% or less exposure to science and technology. Although faculty members were engaged in exciting research, the students were seldom engaged in this research. Students received textbook exposure to study topics rather than practical, hands-on experience. There were consequences to these trends. The industries that eventually received these graduates deemed them inadequate to perform in real-world scenarios. Additionally, there was also an exodus among science majors. The supply of future science teachers for elementary and secondary education suffered. The second factor that inhibited the effectiveness of SMET education efforts was the continued, disparate state of U.S. government funding of SMET-related educational efforts (National Research Council, 1996).

The outcome of the convocation was the identification of focus areas. One focus area was institutional changes to increase the importance of postsecondary SMET education. A second focus area was the identification of common cross-disciplinary needs so that federal investments were better leveraged. A third focus area was the introduction of indicators for education quality and teaching effectiveness. A fourth focus area was an institutional responsibility to provide students with a SMET education that was more hands-on and learning community based

(National Research Council, 1996). Educators introduced small group and collaborative learning approaches in SMET education (Cooper & Robinson, 1997).

The year 1997 brought focused, national attention to SMET skills as the key to America's future. Four important government hearings explored the state of SMET education. The first hearing was held by the House Commission on Science on July 23, 1997 (U.S. Congress, 1997). These revolutionary efforts remained focused on technical excellence and scholarship, yet seemed to remain silent on the people-centered aspects of leadership. Despite national attention and coordinated efforts, the U.S. was unable to keep pace with industry demand for SMET skills. Venture capitalists began funding information technology ventures and dot-coms at a furious pace, which made high technology millionaires at a furious pace. At the end of 1997, the *Washington Post's* front page officially declared a seller's market for information technology skills (Chandrasekaran, 1997).

The NSF (1998) sponsored a first broadly focused workshop to understand potential opportunities and benefits of leveraging information technology in SMET education. America and the world entered a historical period remembered as the dot-com bubble. During the height of internet-based corporate growth, investors were speculating, stock prices were soaring, and technology-based companies were recording unprecedented profits (Caroll, Lux, & Schack, 2000).

Concerns for the future of SMET, alongside threats of a year 2000 (Y2K) bug that threatened aging computing systems (Gunn, 1998), again inflated wages for SMET skills. The 1990s evidenced a decade of struggle for the U.S. education system, and particularly, SMET. Business leaders reported talent shortages and began to anticipate demographic effects of retiring Baby Boomers (Stuller, 2000). Despite national attention, SMET continued to experience an

overall decline in college enrollment, which invited concerns that the U.S. would not keep pace globally developing new SMET knowledge, and eventually face challenges delivering SMET education (Committee on Equal Opportunities in Science and Engineering, 2001).

A new Millennium and U.S. STEM. The world watched as the clock struck midnight on December 31, 1999. SMET entered the year 2000 with few Y2K incidents (U.S. Senate Special Committee on the Year 2000 Technology Problem, 2000). Post Y2K, the world entered a new millennium, and then the dot-com bubble burst, resulting in a global economic downturn (Mann, & Nunes, 2009).

In 2001, the NSF adopted the acronym STEM to acknowledge science and mathematics as underlying disciplines of technology and engineering, as well as to address a subtlety of SMET that suggested science and mathematics were more prominent (Chute, 2009). Also in 2001, the No Child Left Behind Act increased U.S. government involvement in education (No Child Left Behind Act of 2001, 2001; Townley et al., 2005). Then in 2008, the world experienced another economic downturn that arose in the financial industry. Once again, the technology market was impacted. The first decade of STEM in the new millennium was a complex debate about increased U.S. government involvement in education, skills shortages and escalating wages, educational reform, diversity recruiting, outsourcing for cost savings, and immigration to resolve asserted skill shortages.

The current state of U.S. STEM education. On October 8, 2015, the STEM Education Act of 2015 was signed into law. The purpose of the act was to expand research and training for teachers, support research at the NSF, and embed computer science as a STEM discipline given that computing is the highest growth occupation for STEM. Computer science was added as a STEM discipline to extend government funding to these occupations (STEM Education Act of

2015, 2015). The U.S. continues to make progress on a 5-year strategic plan for STEM education (Executive Office of the President of the United States, 2013; Trump, 2017).

The current state of U.S. STEM immigration. Since 1990, the U.S. government has supported the immigration of foreign-born STEM workers to fill unmet STEM needs (Information Technology Industry Council et al., 2012). U.S. Citizen and Immigration Services admits 85,000 highly skilled foreign-born workers to the U.S. each year (U.S. Citizenship and Immigration Services, 2016). 2016 H1-B requests numbered 233,000 (U.S. Citizenship and Immigration Services, 2015). Legislation proposed to increase the number of foreign-born workers admitted to the U.S. each year to between 115,000 and 195,000 depending on market conditions (Immigration Innovation Act of 2015, 2015). More recently, legislation was proposed to protect American workers from over-reliance on foreign workers (H-1B and L-1 Visa Reform Act of 2017, 2017)

Further, the Department of Homeland Security (DHS), U.S. Citizenship and Immigration Services (USCIS), sponsors the F-1 Optional Practical Training (OPT) program that attracts foreign-born individuals to attend college or start a business in the U.S. (U.S. Department of Homeland Security, U.S. Citizenship and Immigration Services, 2015a). On March 11, 2016, the DHS amended the regulations for STEM Optional Practical Training (STEM OPT) F-1 visa extensions that apply to nonimmigrant foreign-born students who obtained STEM degrees in the U.S. Students on F-1 visas who studied STEM in the U.S. may remain in the U.S. to work for 24 months, up from the previous 17-month allowance (U.S. Department of Homeland Security, 2016).

Hosting employers must position these programs as formal mentoring and training programs, and provide wage and other protections (U.S. Department of Homeland Security, U.S.

Citizenship and Immigration Services, 2015b). Separately, foreign-born individuals evidencing extraordinary scientific achievements may obtain 3-year O1-A visas. These visas are renewable in 1-year increments to start new businesses in the U.S. The U.S. government offers additional immigrant and non-immigrant visa options to provide foreign-born individuals with opportunities to start new business ventures in America (U.S. Department of Homeland Security, U.S. Citizenship and Immigration Services, 2015a).

There are at least four sides to the debate that surrounding foreign-born STEM workers in the U.S. One view asserts that foreign-born workers are needed to fill an asserted U.S. STEM skill gap (Information Technology Industry Council et al., 2012). A second view asserts that macro conclusions are misleading and that legitimate and critical shortages are taking place in specific occupations (Carnevale et al., 2011; U.S. Department of Labor, Bureau of Labor Statistics, 2015d). A third view asserts that the alleged U.S. STEM workforce shortage has opened the door to less costly foreign labor ("H-1B and L-1 Visa Reform Act of 2017," 2017; National Science Board, 2018b). In fact, many other countries have strategies in place to attract international STEM workers. A fourth view suggests that one reason foreign-born workers have helped fill the workforce shortage is the fact there is greater availability of foreign-born STEM workers with higher education (National Science Board, 2018e).

The current state of U.S. STEM innovation. R&D is critical to America's preeminence in STEM, as it is the source of technological innovation (National Science Board, 2018c). Technological innovation is dependent on an organization's ability to transfer knowledge and create new products and methods. Innovation results from the thoughtful orchestration of (a) market factors, (b) strategies, (c) infrastructure, (d) work processes, and (e) teaming practices (Frank, Ribeiro, & Echeveste, 2015; Pfeffer, 2007).

The NSF publishes science and engineering (S&E) economic indicators that report the nation's performance in R&D and convert that R&D performance to dollar growth. The most recent indicators evidence that U.S. R&D performance, as a percentage of world performance, is decreasing. Global R&D performance increased to $1.918 trillion in 2015, up $503 billion from 2010. The U.S. and China dominated with approximately 47% of global R&D performance. China represented 21% of the world R&D. The U.S. represented 26% of world R&D, down from 37% in 2000. The U.S. ranked 11th in R&D intensity, behind (a) Israel, (b) South Korea, (c) Switzerland, (d) Japan, (e) Sweden, (f) Austria, (g) Taiwan, (h) Denmark, (i) Germany, and (j) Finland. These 10 countries spent greater percentages of their Gross Domestic Product (GDP) total dollar value of R&D and evidenced a greater percentage of high technology goods production than the U.S. The U.S. has fallen from eighth place in R&D intensity in 2009 (National Science Board, 2018c).

The current state of U.S. STEM innovation in the business and industry sector. The business sector accounts for the majority of R&D investment, R&D funding, and R&D performance, which translates to technological innovation. Actual R&D performance is a function of basic research, applied research, and development. The business and industry sector accounted for 72% of the nation's R&D performance and 67% of the R&D funding for 2015. The business sector produced 58% of applied research conducted in 2015, having funded 53% of applied research. The business and industry sector accounted for 88% of experimental development in 2013, having funded 82% of all experimental development (National Science Board, 2018c).

U.S. STEM job growth projections to 2026. The DoL estimates that STEM jobs across all sectors will increase approximately 11.1% over the 10-year period from 2016 to 2026. STEM

management and non-management jobs will account for approximately 9.9 million jobs by the year 2026. U.S. STEM management jobs are projected to increase 9.9% with higher growth of 12.0% for computer and information systems management jobs. This job growth is higher than the 7.4% growth projected across all U.S. occupations (U.S. Department of Labor, Bureau of Labor Statistics, 2017a).

During the prior projection period of 2014 to 2024, the DoL projected a need for approximately 1,000,000 more workers than the U.S would produce between the years 2014 and 2024. The DoL clarified these projections of both projected shortages and surpluses across STEM occupations (U.S. Department of Labor, Bureau of Labor Statistics, 2015c, 2015d), following several years of conflicting academic and industry responses to previous projections (Carnevale et al., 2011; Jobs for the Future, 2007; National Academy of Sciences et al., 2010). Revised projections for the years 2016 through 2026 suggest that this gap continues to widen based on anticipated increased job growth and lessened participation in the labor force (U.S. Department of Labor, Bureau of Labor Statistics, 2017a). The debate over talent shortages in U.S. STEM is outside the scope of this study; however, it is important to acknowledge that the DoL projections are one major factor driving educational reform and aggressive personnel recruitment.

U.S. STEM workforce data sources. Today, the three government agencies that publish U.S. STEM occupational data include the DoL's Bureau of Labor Statistics (BLS), the U.S. Census Bureau, and the NSF. U.S. STEM data can be confusing and seem to conflict. Government agencies and other organization vary in agendas and purposes, resulting in selected populations meeting diverse purposes (U.S. Department of Labor, Bureau of Labor Statistics, 2015d). This section describes how the data sources were used in this study.

The BLS relies on the Current Population Survey (CPS) for employment and unemployment statistics. CPS is a monthly survey of approximately 60,000 households administered by the U.S. Census Bureau, the survey's co-sponsor. The BLS uses CPS data to produce annual reports on labor force characteristics such as distributions by gender and foreign-born versus native-born (U.S. Department of Labor, Bureau of Labor Statistics, 2017c). The BLS also relies on the American Community Survey (ACS), which complements the decennial survey. The ACS is administered by the U.S. Census Bureau, which surveys 3.5 million households over the year. The data, published on an annual basis, focuses on changes taking place in specific U.S. geographies. There exists some survey content overlap for CPS and ACS. The differing methodologies produce conflicting data for employment and unemployment estimates at a national level (U.S. Census Bureau, n.d.). Third, the BLS relies on the Occupational Employment Statistics (OES) survey for occupational employment and wage data. OES is a semi-annual survey of 200,000 employers, excluding farm-employed and self-employed, administered by State Workforce Agencies. The most recent data set resulted from semi-annual surveys for the 3-year period from November 2013 until May 2016 (U.S. Department of Labor, Bureau of Labor Statistics, 2016b). For the purposes of this study, the BLS data provided employment actuals and 10-year projections, enabling examination of U.S. STEM employment actuals and trends.

The NSF relies on multiple surveys to produce aggregated STEM estimates focused on U.S. R&D and competitiveness, including the science and engineering (S&E) workforce in contrast to STEM. The U.S. Census Bureau and the U.S. Department of Commerce survey graduates and postgraduates on behalf of the NSF. NSF data is published by National Center for Science and Engineering Statistics (NCSES) and subsequently aggregated (NSF, 2017). NSF

data segregates S&E managers, technicians, and technologists as STEM-related occupations. The U.S. Census Bureau and NCSES jointly administer R&D surveys. NCSES data sets segregate business and industry data from government and academia. The segregation of NSF data sets enabled examination of this study's variables for the business and industry sector.

U.S. STEM demographics within business and industry. The NSF (2017) recognizes four sectors in its workforce data sets: (a) 2-year college, (b) 4-year college, (c) business and industry, and (d) government. The present study focused on U.S. STEM within the business and industry sector for several reasons. First, the U.S. business and industry sector represents the majority of R&D activity and performance (National Science Board, 2018c). Second, government and academia present unique work environments. Third, academia has not evidenced STEM skill shortages, but rather surpluses, particularly in life and physical sciences. Fourth, government experienced limited growth and some decline (U.S. Department of Labor, Bureau of Labor Statistics, 2015d). Based on NSF data sets, the total population of U.S. STEM within business and industry is approximately 5,529,000 jobs (Table 2). Where possible, the data in this literature review present U.S. STEM populations within business and industry.

The U.S. government remains committed to enacting STEM policy and reforming STEM education to secure America's future (STEM Education Act of 2015, 2015; U.S. Department of Education, 2018; U.S. Department of Education, Academic Improvement and Teacher Quality Programs, 2015). These initiatives are targeting students and underrepresented populations, both within and beyond U.S borders (U.S. Department of Homeland Security, 2016). It is reasonable to anticipate that these well-resourced initiatives will be successful, contributing to an increasingly cross-cultural U.S. STEM workforce that will shift ideals of leadership.

Table 2

NSF SESTAT 2015 U.S. STEM Estimates by Occupation and Sector in Thousands

Occupation	2-year college/ other		4-year college/ medical		Government		Business and Industry		Total	
	Weighted Average	Row %	Weighted Average	Row %	Weighted Average	Row %	Weighted Average	Row %	Weighted Average	Row %
Postsecondary teachers - computer and math sciences	40	37%	69	63%	.	.	.	.	109	100%
Computer, information, and mathematical scientists	55	2%	123	5%	226	9%	2,135	84%	2,538	100%
Biological and medical scientists	1	0%	126	37%	62	18%	153	45%	342	100%
Postsecondary teachers - life and related sciences	18	21%	70	79%	.	.	.	.	88	100%
Other life and related scientists	1	0%	46	22%	56	27%	107	51%	209	100%
Chemists, except biochemists	0	0%	17	16%	13	13%	76	72%	105	100%
Physicists and astonomers	1	3%	14	38%	8	23%	13	36%	36	100%
Postsecondary teachers - physical and related sciences	12	19%	51	81%	.	.	.	.	63	100%
Other physical and related scientists	0	0%	14	12%	39	34%	62	54%	115	100%
Economists	0	0%	10	27%	13	35%	14	38%	37	100%
Psychologists	48	23%	27	13%	25	12%	108	52%	208	100%
Postsecondary teachers - social and related sciences	27	16%	145	84%	.	.	.	.	172	100%
Other social scientists	1	1%	29	18%	55	34%	77	48%	162	100%
Other engineers	1	0%	22	4%	72	12%	492	84%	587	100%
Chemical engineers	.	.	4	7%	2	3%	59	91%	66	100%
Civil engineers	.	.	4	2%	83	37%	136	61%	223	100%
Electrical, electronic, and computer hardware engineers	2	0%	14	4%	29	8%	301	87%	345	100%
Mechanical engineers	2	1%	9	3%	16	5%	275	91%	302	100%
Postsecondary teachers - engineering	2	6%	39	95%	.	.	.	.	41	100%
Health-related occupations	166	4%	450	10%	378	8%	**3,595**	78%	4,589	100%
S&E managers	3	0%	44	5%	145	16%	709	79%	902	100%
S&E pre-college teachers	968	100%	0	0%	.	.	.	.	968	100%
Other S&E-related occupations	7	1%	42	4%	117	12%	813	83%	979	100%
Subtotal	1,355	10%	1,366	10%	1,340	10%	9,124	69%	13,185	100%
Less health related (excluded							(3,595)			
Adjusted total business and industry							5,529			

Note. STEM jobs in U.S. business and industry are the population for this study and comprise the majority of U.S. STEM jobs. Adapted from Scientists and Engineers Statistical Data System, by the National Science Foundation, National Center for Science and Engineering Statistics, 2017. No copyright per Title 17 U.S.C., Section 105.

Section summary. This section explored U.S. STEM's history, evolution, current state, and future state. History has shown that, since its inception, America is an evolving community of scientists and inventors facing new frontiers, global interdependence and competition, and economic uncertainty. STEM's evolution demonstrates that America has a long history of struggles with the U.S. education system that readies workers who will ensure the continued prosperity of the nation. STEM's current and projected future states offer evidence that continued educational reform and recruiting efforts are shifting demographics toward a more cross-cultural workforce.

Next, section two explores the GLOBE Theoretical Model and GLOBE leadership scales.

GLOBE Theoretical Model

The GLOBE theoretical model (see APPENDIX B) originated as an integration of four leadership theories: (a) ILT (Lord & Maher, 1991); (b) value-belief theory (Hofstede, 1980; Triandis, 1995); (c) implicit motivation theory (McClelland, 1985); and (d) structural contingency theory of organizational form and effectiveness, as published in *Anti-Management Theories of Organization: A Critique of Paradigm Proliferation* (as cited in House et al., 2004). The GLOBE theoretical model has evolved to incorporate findings across multiple phases of GLOBE (Chhokar, Brodbeck, & House, 2007; House et al., 2004, 2014). Only the first theory, ILT, will be addressed in this study. The three remaining theories are outside the scope of the present study.

Culturally-endorsed implicit leadership theories. Building upon ILT, GLOBE proposed that societal culture affected organizational cultural values and practices, leadership values and behaviors, and leader acceptance. In GLOBE, these CLTs arose at societal and organizational levels of analyses. In contrast, ILTs examined in this study are measured at the individual level of analyses (House et al., 2004). ILT will be explored in section three.

The GLOBE project. GLOBE was a multi-phase, longitudinal study of societal and organizational culture, organizational behavior and effectiveness, and leadership. GLOBE was conceived by Dr. Robert J. House in 1991 at the Wharton School at the University of Pennsylvania. In the early 1990s, the U.S. government was beginning a collective emphasis on SMET/STEM education (Federal Coordinating Council for Science, 1993). Meanwhile, in August 1994, researchers from 38 countries were gathering at the University of Calgary in Canada to consider the scope and administration of the GLOBE project (House et al., 2004).

Twenty-two years later, more than 200 researchers from multiple disciplines surveyed more than 1,900 companies in 69 societies (House et al., 2014). GLOBE benefitted from several rounds of NSF funding (House et al., 2002; National Science Foundation, n.d.). Today, GLOBE is hosted at the University of Victoria in British Columbia (GLOBE Foundation, n.d.).

GLOBE phase one. GLOBE has encompassed three phases to date. The first phase of GLOBE produced two instruments: the GLOBE culture scales and the GLOBE leadership scales. The GLOBE culture scales measure societal and organizational culture, distinguishing between the *as-is* and the *should be* state of culture. The GLOBE leadership scales measured the should be state of leadership, or leadership values (Globe Foundation, 2006b; Hanges & Dickson, 2004). The culture scales were not used in the present study. The present study applied the leadership scales to determine the degree to which certain leadership attributes associated with ILTs are expected to be viewed as either inhibiting or contributing to outstanding leadership within the U.S. STEM workforce in the business and industry sector.

GLOBE leadership scales. The multi-level structure of the GLOBE leadership scales consists of three levels. The first level comprises 112 leadership attributes, which were used in this study. The 112 attributes individually correspond to 21 leadership scales known as the 21 primary CLTs, which were not used in this study. The 21 primary CLTs represent a westernized view of positive and negative aspects of leadership. Finally, the 21 primary CLTs individually correspond to *six global leadership dimensions* (six global CLTs), which were not used in this study (see APPENDIX C).

Construct-driven approach to scale development. The GLOBE leadership scales were designed using a construct-driven approach. The theories were selected and then the leadership scale items were written to align with the selected theories. Specifically, GLOBE leadership

scales test CLTs at societal and organizational levels of analysis by comparing results between societies and organizations (House et al., 2014). The multilevel structure allows patterns to emerge with each successive level of aggregation. As a first step, consistent with approaches to developing items to measure ILT (Lord & Maher, 1991), GLOBE created a comprehensive list of 382 leadership attributes and characteristics and accompanying definitions. The attributes and characteristics were constructed from but not limited to concepts in leadership literature (Hanges & Dickson, 2004; House & Aditya, 1997).

Pilot studies. Phase one proceeded with two pilot studies. The purpose of the first pilot was to determine a factor structure for the questionnaire. The purpose of the second pilot was to replicate the results. The pilot studies collected survey data from 1,943 study participants. Surveys underwent translation into multiple languages, back translation, and revision to ensure concepts were translated sufficiently. Activities were facilitated by in-country investigators. Leadership scale items were eventually reduced to 112 items that exhibited measurement equivalence across many countries. Western bias was resolved when possible. In some instances, new items were written (Hanges & Dickson, 2004, 2006).

The two pilot studies also enabled aggregation of the scales and confirmed sound psychometric properties of the 21 primary and six global scales at the societal and organizational levels of analysis. GLOBE used both conceptual and statistical processes to group scale items. To produce the multilevel structure, GLOBE applied multifactor confirmatory factor analysis primarily using the comparative fit index (CFI). CFI for the leadership scales averaged 0.92. Through this process, some of the items were regrouped within the scales. Average internal consistency for the 21 CLT scales was 0.75. Most scales evidenced adequate internal consistency although some Cronbach alphas were less than optimal (Hanges & Dickson, 2004). As the multi-

level scales were not used in the present study, further details regarding scale aggregation and analyses will be omitted from this literature review.

Criticisms. All cross-cultural studies invite debate, and GLOBE is no exception. Unique criticisms directed at the GLOBE leadership scales have primarily focused on the aggregation of GLOBE's multi-level scales (Peterson & Castro, 2006). Although the multi-level structure was not used in this study, it is important to describe the structure to understand how the 112 scale items are used in this study. GLOBE has addressed criticisms with additional details regarding their analysis (Hanges & Dickson, 2006).

GLOBE phases two and three. GLOBE phase two surveyed approximately 17,300 middle managers in 951 organizations, from 62 societies in three industries, including telecommunications, financial services, and food processing. These industries were selected because they were widely present in different countries and had vastly different in operations from each other. GLOBE phase two achieved a set of samples in all three industries across 40 societies of the 62 societies surveyed (House et al., 2004).

Regarding survey completion, half of the respondents in each organization completed form alpha, which measured cultural practices and leadership values. The other half of the respondents completed the Globe Research Survey Form Beta that measured cultural *values* and leadership values (GLOBE Foundation, 2006a). Only the culture scale items differed in the Alpha and Beta forms. The leadership scale items, which measured leadership values, were the same in both forms. Both study participant groups were very similar, which guarded against common source response bias. Study participants in each society numbered from 27 to 1,790 (House et al., 2004). GLOBE three phase surveyed respondents regarding their views of executives in their companies, to explore the effects of executive leadership on organizations

(House et al., 2014). Phase three is outside the scope of the present study, therefore further details regarding phase three will be omitted from this literature review.

As described earlier, GLOBE adopted a construct-driven approach to developing a multilevel structure, which specified theory in advance. The scale items were written to correspond with selected theories or constructs that emerge at aggregated levels of the multi-level construct. Consequently, the psychometrics of the aggregated scales were tested and not the 112 individual scale items. An alternative approach would have been to use an empirical or criterion-referenced approach that would necessitate psychometric testing of the individual scale items. This second approach allows for identification of new constructs (Hanges & Dickson, 2004). Although the multi-level scales were not used in this study, it is worth mentioning that the scales evidence some positive psychometric properties at the individual level of analysis and it is proposed that further exploration of these lines is required (Chhokar et al., 2007).

Country clusters. GLOBE selected country clusters as a framework to contextualize the difference in culture across nations and societies. The GLOBE country clusters evidence that individual ideals of leadership differ across nations and societies (House et al., 2014). To achieve validity of the GLOBE clusters, GLOBE used discriminant analysis to differentiate cluster membership. First, GLOBE split the data in half at the individual level to establish a development sample and a holdout sample. The holdout sample was used to test whether the discriminant analysis was sufficiently robust. To assess the proximity and distance of the clusters from both societal practices and values perspectives, GLOBE used a Multidimensional Scaling Procedure (MDS). MDS enabled consideration of different dimensions of culture and contributed to a meta-configuration of the clusters. To understand the effect of society on individual values and practices, GLOBE used eta squares to contrast the cluster effects rather than the individual

effects. Different dimensions of culture drove different variations. With respect to this study, which measured perceptions toward 112 leadership attributes, the final clusters captured 54% of the effects of societal culture on values and 65% of societal effects of practices. GLOBE concluded that the societal-based cluster was relevant as a unit of analysis (Gupta & Hanges, 2004).

Criticisms. Country clusters have been attempted, debated, and negotiated for more than half a century (Gelbard et al., 2009; House et al., 2004; Ronen & Shenkar, 2013). There are at least three approaches to creating country clusters, including: (a) geography; (b) ethnic social capital, with consideration of migration implications; and (c) religion and linguistics. One reason country clusters and comparative cultural studies are criticized is that economics and other external factors can marginalize across any of these clustering approaches (Bird. & Mendenhall, 2016).

GLOBE findings relevant to the present study. GLOBE aggregated survey results and tested for CLTs at the societal and organizational levels of analyses. Relevant to the present study, GLOBE also sought to identify those individual leadership attributes expected to be endorsed across cultures. Twenty-two leadership attributes were identified as positively contributing to outstanding leadership. These attributes achieved average societal scores of 5.0 on a 7-point scale for 95% of country averages and achieved 6.0 or greater for world means. There were eight leadership attributes of 112 identified as inhibiting outstanding leadership. These behaviors received societal averages scores lower than 3.0 on a 7-point scale for 95% of country averages and lower than 3.0 for world means. There were 35 leadership attributes identified as culturally contingent, whether or not these attributes contributed to outstanding leadership (see APPENDIX C).

Section summary. GLOBE was undertaken to understand the intersection of culture, leadership, and related outcomes. Relevant to this study and application of the GLOBE leadership scales, GLOBE has explored how culture shapes the views of the roles leaders play in an organization and the attributes expected of leaders. Beyond the scope of this study, GLOBE also explored the influences of culture, society, or organization on a leader's ability to influence in the workplace. GLOBE has also explored variances in leadership style weighed against values and expectations within the organizational or societal culture. GLOBE has investigated the extent to which culture affects organizational structure and processes. Finally, GLOBE has also studied the aspects of leadership most common across various societal and organizational cultures (House et al., 2002, 2014).

The leadership aspects of the GLOBE theoretical framework are built on ILT, which the next section of this literature review examines ILT.

Implicit Leadership Theories

GLOBE's findings suggest that many societal and organizational factors influence conceptions of leadership. Societal culture arises from history, local customs, politics, geography, migration, language, climate, and other factors, which results in unique societal and organizational cultures. Unique cultures combined with personal histories result in implicit theories of leadership. ILTs refer to an individual's invisible system of beliefs or *schemas* about leaders and leadership (House et al., 2002, 2014; Lord & Emrich, 2000).

Cognitive leadership theory. ILT is categorized as a *social-cognitive theory.* Social refers to the notion that leadership occurs through interaction with others. Individuals become *social perceivers*. Cognitive is to the notion that through experience, perception, and nonconscious information processing, individuals engage in internal reasoning that results in

expectations directed toward leaders and leadership. These expectations placed on leaders are ILTs or *leadership schemas*. Schemas have also been likened to stereotypes (Eagly & Antonakis, 2015).

Lord and Emrich (2000) articulated three sets of assumptions that shaped the evolution of cognitive leadership theories. The first set of assumptions concerns the causality of leadership, which adopts one of two lenses. One lens adopts the perspective that leadership emanates from a leader's actions. This leader-centered lens examines leadership's effects on particular outcomes, most typically testing leader attributes or behaviors, or leadership effectiveness. Leadership effectiveness concerns whether the acts of leadership are viewed as effective (Eagly & Antonakis, 2015). Another lens adopts a perspective that leadership emanates from a social context. This lens examines a social system and conditions for leadership, typically testing *leader emergence*. Leadership emergence describes whether an individual is identified by others as a leader (Eagly & Antonakis, 2015). These conditions may occur situationally or within followers' perspectives (Eagly & Antonakis, 2015; Lord & Emrich, 2000).

The second set of assumptions concern the "nature and use of the perceiver's *leadership schema"* (Lord & Emrich, 2000, pp. 552-553). One lens adopts the perspective that a perceiver's leadership schema remains relatively static throughout time. Another more contemporary lens adopts the perspective that a perceiver's leadership schema is dynamic. Today, it is generally suggested that leadership schemas change over time (Lord & Emrich, 2000).

The third set of assumptions, beyond the scope of the present study, directly concerns a study's dependent variables where cognitive processes themselves are measured. This third and emerging set of assumptions tests dependent variables, such as memory or attention, as proximal

intervening cognitive processes, to explore mediating effects on outcomes (Lord & Emrich, 2000).

Implicit leadership theory. All leadership theories generally highlight outcomes related to either leadership emergence, leadership effectiveness, or both. ILT, the underlying leadership theory of GLOBE, highlights both elements. Lord and Maher (1991), who proposed ILT, distinguished between an individual's ability to recognize leadership based on perception and an individual's cognitive processes. Regarding leader emergence, a perceiver can view certain traits or behaviors in others and perceive the traits or behaviors as leadership. Regarding leader effectiveness or *categorization*, the perceiver will perceive whether another individual is a leader and then judge the acts of leadership as effective or ineffective based on that individual's ILTs.

Leader emergence. Leader emergence occurs as a process of perception and nonconscious information processing. First, the perceiver holds an invisible system of beliefs or ILTs that place certain conditions on leaders and leadership. This system of beliefs or schemas, which results from the perceiver's personal history and experiences, may encompass traits embodied by leaders or behaviors attributed to leaders. Relevant to the present study, the perceiver has an invisible belief system regarding what traits leaders will possess or what behaviors leaders will exhibit.

Second, the perceiver engages in cognitive information processing to evaluate the match between the perceiver's schemas or ILTs and the observed traits and behaviors in an observed individual. Together, perception and cognitive information processing affect the likelihood that the perceiver will perceive an observed individual as a leader. The implication is that, regardless of an observed individual's leadership traits and characteristics or aspirations, the perceiver's schemas affect whether the observed individual embodies the role of leader in the perceiver's

mind (Day, 2014; Lord & Maher, 1991). As summarized by Moan and Hetland (2012), “a prerequisite for being a successful leader is to be perceived as a leader” (p. 6).

Leader categorization. Leader categorization occurs as a process of perception and nonconscious information processing. First, once a perceiver identifies an observed individual as a leader, the perceiver observes outcomes, infers whether those outcomes are the result of the leader’s behaviors, and infers whether the leader’s behaviors were either effective or ineffective (Eagly & Antonakis, 2015). The outcomes of leadership, including the perceived effectiveness of certain behaviors, are dependent on follower responses to leadership (Day, 2014).

Further, the perceiver infers whether perceived leadership behaviors by an observed individual either contributed to or inhibited positive outcomes (Lord & Maher, 1991). One challenge here is that certain leadership traits or constructs can be idealized or even romanticized, and in reality, may lack a direct connection to organizational results. Individuals may conclude that certain actions constitute leadership and then conclude that those actions contributed to positive outcomes, whether or not the actions truly contributed to the outcomes (Lord & Dinh, 2014).

A second challenge is that an observed individual may be mismatched to perceiver’s ILTs, and consequently not be identified as a leader. The observed individual may not earn opportunities to influence the organization as a leader (Lord, de Vader, & Alliger, 1986). Consequently, notions of ILTs have raised questions regarding the internal validity of leadership assessments and tools (Rush, Thomas, & Lord, 1977). ILTs potentially bias the attempted measurement of effective leadership because ILTs bias perceptions of leaders and ideals of leadership (Wilderom et al., 1999).

Section summary. ILTs emerge from culture and personal histories, evolve through personal experiences, and then arise through perception and thought processes. Leadership schemas may change over time (Lord & Emrich, 2000). Perceivers place certain conditions on leaders and leadership resulting from an invisible system of beliefs or ILTs. Leader emergence occurs when the perceiver concludes an observed individual embodies behaviors that the perceiver attributes to leaders. If there is not a fit between the perceiver's ILTs and perceptions of the observed individual, the observed individual may not win opportunities to lead. Leader categorization occurs when the perceiver infers whether organizational outcomes resulted from a leader's behaviors and whether those behaviors were either effective or ineffective (Eagly & Antonakis, 2015). Certain traits may be idealized although lacking true connection to an organization's results.

Next, this literature review explores views of effective leadership and relationship to the present study's variables. The shifting demographics within U.S. STEM and ILTs suggest important implications for leaders in U.S. STEM.

U.S. STEM Workforce and Implications for Views of Leadership

As described in the previous section of this literature review, it is generally accepted that leadership schemas may change over time (Lord & Emrich, 2000). Similarly, it is generally accepted that leadership schemas are learned, such as those learned through society and individual experiences. Specialized initiatives endeavor to attract more generations, women, minorities, and foreign-born workers to U.S. STEM occupations (Javidan & Bowen, 2013; STEM Education Act of 2015, 2015; U.S. Chamber of Commerce, Economics and Statistics Administration, 2017; U.S. Department of Homeland Security, 2016; White House Office of Science and Technology Policy, 2015). These demographic shifts hold implications for

leadership, as individuals from different societal cultures differ in their perceptions of leadership effectiveness (Javidan et al., 2006). Moreover, factors such as age and gender potentially amplify culture and explain variation in the effects of cultural values (Chhokar et al., 2007). An individual's culture and values may occur at a gender level, generation level, national level, social class level, and even the occupational or professional level (Hofstede et al., 2010).

Gender and views of outstanding leadership in U.S. STEM. Women are an untapped source of talent for STEM occupations (Dasgupta & Stout, 2014). Efforts to increase the overall gender diversity in STEM occupations originated in the 1970s and 1980s. Presently, the U.S. government continues to broaden cross-agency partnerships to fortify recruitment efforts and educational opportunities to attract women and underrepresented minorities to STEM occupations (Executive Office of the President of the United States, 2013; U.S. Congress, 2017; U.S. Department of Education, Academic Improvement and Teacher Quality Programs, 2015).

The number of women who study in STEM fields is increasing; women graduates in core STEM fields increased 130% between 1990 and 2013. In contrast, men graduates increased approximately 76% during this same period (U.S. Chamber of Commerce, Economics and Statistics Administration, 2017). The presence of women in STEM occupations doubled since 1990. While the number of women in U.S. STEM increased, the overall percentages remained relatively flat (National Science Board, 2018; U.S. Chamber of Commerce, Economics and Statistics Administration, 2017). While more women are electing to study in STEM occupations, many women elect non-STEM occupations after graduation (see APPENDIX J).

Overall, women remain underrepresented in STEM occupations (Beede et al., 2011). Women presently account for approximately one-half of the U.S. workforce and only one-quarter

of the U.S. STEM workforce. Although science occupations successfully attract women, most engineering occupations struggle to attract women (see Table 3).

Table 3

NSF U.S. STEM in Business and Industry, by Gender and Occupation, in Thousands

Occupation	Women		Men		Total	
	Weighted Count	Row %	Weighted Count	Row %	Weighted Count	Row %
Computer, information, and math scientists	504	23.6%	1,630	76.4%	2,135	100%
Biological and medical scientists	78	50.6%	76	49.4%	153	100%
Other life and related scientists	50	46.7%	57	53.3%	107	100%
Chemists, except biochemists	26	34.7%	49	65.3%	76	100%
Physicists and astonomers	1	6.1%	12	93.9%	13	100%
Other physical and related scientists	22	35.4%	40	64.6%	62	100%
Economists	6	42.1%	8	57.9%	14	100%
Psychologists	76	70.6%	32	29.4%	108	100%
Other social scientists	47	61.2%	30	38.8%	77	100%
Other engineers	84	17.0%	408	83.0%	492	100%
Chemical engineers	13	22.7%	46	77.3%	59	100%
Civil engineers	19	14.2%	117	85.8%	136	100%
Electrical, electronic, and computer hardware	33	10.8%	268	89.2%	301	100%
Mechanical engineers	21	7.8%	253	92.2%	275	100%
S&E managers	201	28.4%	508	71.6%	709	100%
Other S&E-related occupations	172	21.1%	641	78.9%	813	100%
Total	1,354	24.5%	4,176	75.5%	5,529	100%

Note. Women represent nearly half of the U.S. workforce yet only 25% in STEM, yet ranged from 6% to 71% by occupation. Adapted from Scientists and Engineers Statistical Data System, by the National Science Foundation, National Center for Science and Engineering Statistics, 2017. No copyright per Title 17 U.S.C., Section 105.

Given well-resourced education and recruiting efforts, it is reasonable to anticipate that the percentages of women who elect U.S. STEM occupations will continue to increase. As summarized earlier in this section, culture and values may occur at a gender level (Hofstede et al., 2010). Specifically, men and women in U.S. STEM may espouse different values and views toward the characteristics of outstanding leaders. For example, one factor inhibiting women's choice of STEM occupations and subsequent retention is the perceived low emphasis on community and people in the U.S. STEM workplace. One theme that is present in the literature is the need to strengthen perceptions among women that the STEM workplace meets women's

communal goals, which are associated with work environments that offer a sense of community and belonging for the organization's members. Attributes of a communal environment include warmth, sensitivity, and cooperation (Diekman et al., 2015). The implications for views of outstanding leadership characteristics are that women may value community-building attributes in leaders, as well as those attributes contributing to a work environment that is inclusive and cooperative.

Further, women are highly subject to social identity threat in the STEM workplace, which is the feeling of being devalued. Social identity threat among women in STEM is triggered when women feel their input is not as valued as men's input (Diekman et al., 2015). Women in U.S. STEM may value those leadership characteristics that further a participative, egalitarian environment. U.S. STEM women may value those leadership characteristics associated with mentoring, which is shown to increase women's confidence and success in the workplace (U.S. Chamber of Commerce, Economics and Statistics Administration, 2017).

Age and views of outstanding leadership in U.S. STEM. The U.S. must aggressively recruit new generations to study and work in STEM fields. The availability of work U.S. STEM workers to meet future demand is debated (U.S. Department of Labor, Bureau of Labor Statistics, 2015d). Earlier projections from the DoL asserted that the U.S. must produce one million more STEM graduates than would be produced over the 10-year period ending 2024 (U.S. Department of Labor, Bureau of Labor Statistics, 2015c). It was suggested that a mere 10% increase in the retention of STEM graduates that enter STEM fields would be sufficient to meet three-quarters of the number of STEM graduates required (Executive Office of the President, 2012). The latest 2016-2026 projections evidence slightly higher growth although revised STEM analysis is pending (U.S. Department of Labor, Bureau of Labor Statistics, 2017a).

The U.S experienced only modest increases in STEM graduates between the years 2000 to 2015 (National Science Board, 2018; see Figure 1). Overall, analysis of education, government, and business and industry sectors seems to support conclusions that there will be shortfalls in certain STEM skills, but not all, necessitating continued recruitment of new generations to U.S. STEM (Alphonse, 2014; U.S. Department of Labor, Bureau of Labor Statistics, 2015d).

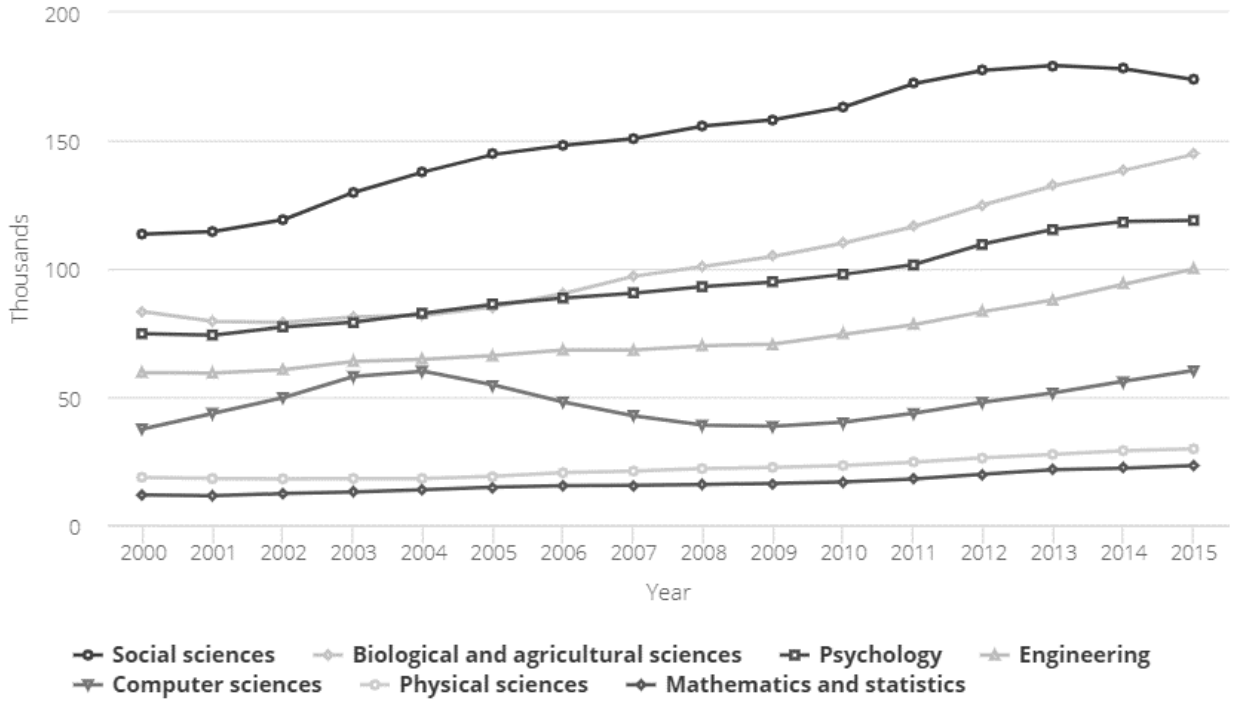


Figure 1. U.S. STEM bachelor's degree graduates between 2000 and 2015 evidence a slight trend upward. Reprinted from *Science and Engineering Indicators 2018,* by the National Science Board, 2018, Chapter 2, p. 55. No copyright per Title 17 U.S.C., Section 105.

Although enrollment in STEM degrees is gradually increasing, retaining graduates in STEM occupations remains a challenge. Many STEM graduates select non-STEM occupations after graduation (see APPENDIX K). Data from the NSF similarly evidence a considerable population of Baby Boomers will be eligible for retirement. NSF data also evidence that workers are remaining in the workforce longer (National Science Board, 2018e). Together, these data suggest more generations will be present in the U.S. STEM workplace (see Figure 2).

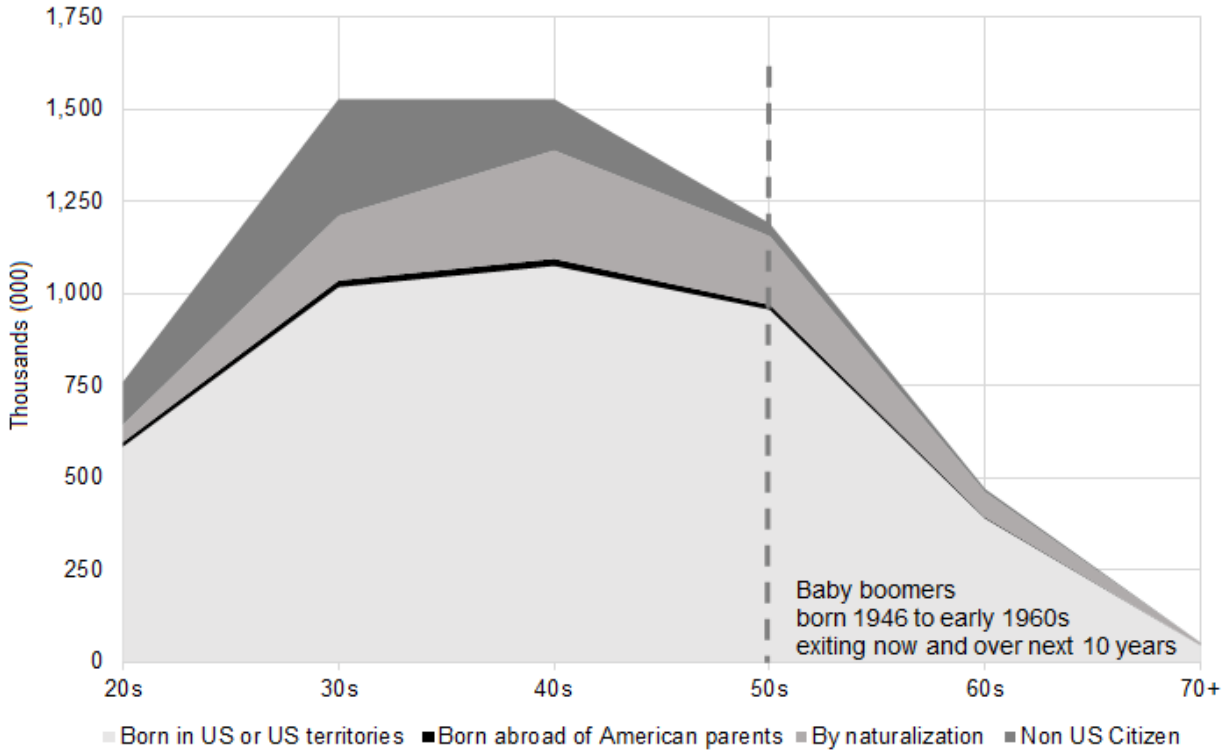


Figure 2. Baby Boomers are departing the workforce. Earlier generations, naturalized citizens, and non-citizens are the core U.S. STEM workforce. Adapted from *Scientists and Engineers Statistical Data System,* by the National Science Foundation, National Center for Science and Engineering Statistics, 2017. No copyright per Title 17 U.S.C., Section 105.

As a result of well-resourced education and recruiting efforts to recruit new generations and the effects of retirement-eligible workers who remain in the workforce, there is a broad representation of several generations in the U.S. STEM workplace. Millennials and Generation X workers now dominate the workforce, replacing Baby Boomers who continue to reach the age for retirement eligibility (U.S. Department of Labor, Bureau of Labor Statistics, 2017a). Each generational cohort that enters the U.S. workforce brings a new set of values and characteristics to the workplace. These values are shaped by societies. For example, the characteristics and values of generational cohorts may be impacted by trends in national education.

Traditionally, STEM evolved as independent disciplines in K-12 and in America's colleges, emphasizing the technical aspects of each discipline (Walls, 2000). In response to growing concerns about competitiveness in innovation and economic growth, the U.S. undertook

the Next Generation Science Standards in STEM to enable student exploration of connections across STEM disciplines. These standards are driving a more integrative, systemic approach to education across the STEM disciplines. This integration is a complex undertaking, integrating technical aspects of each discipline and embracing newer theories in learning sciences, educational psychology, and cognitive psychology. STEM education now includes critical social elements such as teaming and intercultural collaboration. There is also a growing emphasis on a cross-disciplinary approach, joint decision-making, and collaborative problem-solving in U.S. STEM education (Committee on Integrated STEM Education et al., 2014).

As summarized earlier in this section, culture and values may occur at a generational level (Hofstede et al., 2010). Demographic shifts and national education trends present implications for views of outstanding leadership characteristics. Different generations in U.S. STEM may evidence differing views of outstanding leadership. Millennials are reported to be more diverse than previous generations (Hill & Stephens, 2003). Older generations focused on STEM leadership in the context of technical accomplishment within STEM disciplines. There are differing views whether STEM leadership includes technical expertise, people leadership or both (Hartmann & Jahren, 2015). Whereas older generations may place more emphasis on technical and administrative leadership characteristics, younger generations entering U.S STEM workforce may favor leadership behaviors most contributing to collaborative teaming approaches. Millennials are shown to value appreciation, support, communication, and workplace flexibility that fosters a balance between work and personal lives (Finn & Donovan, 2013).

National origin and views of outstanding leadership in U.S. STEM. The U.S. has long supported immigration as one route to resolving unmet STEM employment needs expressed by U.S. employers (Information Technology Industry Council et al., 2012). Each year, 85,000 new

foreign-born workers are invited to enter the U.S. through the U.S. H1-B visa program. These 85,000 entrants satisfy requests that number more than 200,000 among U.S. employers (U.S. Citizenship and Immigration Services, 2015).

Additionally, between the period of March 2015 and March 2016, 40.4% of foreign students participating in F and M visa programs studied STEM in the U.S. This percentage represents 478,851 students with 416,926 originating from Asia. STEM F and M visas in California experienced 24% growth between March 2015 and March 2016 (U.S. Department of Homeland Security, U.S. Immigration and Customs Enforcement, 2016). The majority of these students entering the U.S. for the purposes of employment hold F-1 student visas, which were recently extended to permit employment via OPT up to 24 months following college graduation (U.S. Department of Homeland Security, 2016). These visas and OPT are gateways to permanent resident status in the U.S.

The number of foreign-born workers in U.S. STEM continues to increase year over year. According to the DoL (2017b), in 2016 these levels reached 25% (see Table 4). According to the NSF (2017), foreign-born workers comprised an even higher percentage of 26.5%, within the U.S. STEM workforce in business and industry (see Table 5).

The increase of foreign-born workers in U.S. STEM suggests important implications for leadership in the U.S. STEM workplace. Each national culture is a unique blend of historical, religious, economic, and other societal factors. Culture and values may occur at a national level or organizational level (Hofstede et al., 2004, 2010), and cultural factors are known to influence views of leadership effectiveness (House et al., 2014).

Table 4

DoL U.S. STEM Averages in Thousands

Occupation	Foreign Born						Native born						Total	
	Men		Women		Total		Men		Women		Total			
	Average	%	Average	%	Average	%	Average	%	Average	%	Average	%	Average	%
Total employed	15,007		10,772		25,779		65,561		60,096		#####		151,436	100%
Total STEM employed	1,561	75.5%	506	24.5%	2,067	**22.8%**	5,245	75.1%	1,743	**24.9%**	6,988	**77.2%**	9,055	100%
Computer and mathematical	900	6.0%	291	2.7%	1,191	4.6%	2,491	3.8%	901	1.5%	3,393	2.7%	4,584	100%
Architecture and engineers	480	3.2%	86	0.8%	566	2.2%	2,164	3.3%	361	0.6%	2,524	2.0%	3,090	100%
Life, physical, and social sci	180	1.2%	129	1.2%	309	1.2%	590	0.9%	481	0.8%	1,071	0.8%	1,380	100%

Note. An estimated 22.8% of U.S. STEM jobs were held by foreign-born workers in 2016. Adapted from "Occupational employment statistics," by the U.S. Department of Labor, Bureau of Labor Statistics, 2017 (http://www.bls.gov/oes/). No copyright per Title 17 U.S.C., Section 105.

Table 5

NSF U.S. STEM Weighted Averages in Business and Industry in Thousands

Occupation	Native born		Foreign born								Total	
			US citizen of American parent		US Citizen by naturalization		Non US citizen		Total			
	Weighted Count	Row %	Weighted Count	Row %	Weighted Count	Row %	Weighted Count	Row %	Weighted Count	Row %	Weighted Count	Row %
Computer and mathematical scientists	1,454	68.1%	25	1.2%	329	15.4%	326	15.3%	681	31.9%	2,135	100%
Biological, agricultural & other life sci	193	74.1%	2	0.6%	33	12.9%	32	12.4%	67	25.9%	260	100%
Physical and related scientists	119	79.0%	3	1.9%	18	11.9%	11	7.2%	32	21.0%	151	100%
Social and related scientists	175	87.7%	2	0.9%	11	5.6%	12	5.8%	24	12.3%	199	100%
Engineers	986	78.1%	12	0.9%	157	12.4%	107	8.5%	276	21.8%	1,262	100%
S&E related occupations	1,139	74.8%	24	1.6%	230	15.1%	129	8.5%	383	25.2%	1,522	100%
Total	4,066	73.5%	68	1.2%	778	14.1%	617	11.2%	1,463	26.5%	5,529	100%

Note. An estimated 26.5% of U.S. STEM jobs in business and industry were projected as held by foreign-born. Adapted from Scientists and Engineers Statistical Data System, by the National Science Foundation, National Center for Science and Engineering Statistics, 2017. No copyright per Title 17 U.S.C., Section 105.

Culture is complex. Two approaches to contextualizing culture for purposes of research and understanding include societal cultural dimensions and country clusters. Societal cultural dimensions of GLOBE, underpinning the GLOBE leadership scales that will be applied in this study, were built on Hofstede's cultural dimensions. Geert Hofstede's (1980) seminal research, which surveyed 117,000 employees at IBM across 60 countries, produced a four-dimensional model of national culture that later evolved to five dimensions. Hofstede's dimensions of national culture drove an important shift in cultural studies from one variable to many variables

(Minkov & Hofstede, 2011). GLOBE built on Hofstede's five culture dimensions, producing a total of nine culture dimensions that can be applied to both organizations and societies. Although GLOBE's culture dimensions are outside the scope of this study, the implication of immigration is that each unique combination of cultural factors from a nation and its organizations produce unique sets of values through which individuals view leadership.

Country clusters. Considering all the nations, societies, and sub-societies across the world, it is impossible to account for the myriad cultural dimensions and sub-dimensions that have emerged in the past and will emerge in the future. The GLOBE Theoretical Model, described in the Theoretical Framework section of this literature review, adopts country clusters to characterize cultural similarities and differences in organizations and societies (see APPENDIX D). The practice of grouping countries to compare cultural preferences has occurred for more than 50 years. Factors generally considered in the formation or country or country clusters include geography, migration, religion, language, and social factors (Gupta, Hanges, & Dorfman, 2002). Country clusters are criticized as disregarding the complex nature of culture (Minkov & Hofstede, 2012). Although debated, country clustering and related indices are useful in providing context for cultural exploration (Gupta & Hanges, 2004; Minkov & Hofstede, 2012; Ronen & Shenkar, 2013). Findings on U.S. culture that inform country clusters and indices are consistent across the literature (Gelbard et al., 2009; Ronen & Shenkar, 2013; Yeganeh, 2013).

Nordic cluster. The countries composing GLOBE's Nordic Cluster include (a) Denmark, (b) Finland, and (c) Sweden (House et al., 2014). GLOBE's aggregated results at the societal level of analysis evidence these countries most favor those leadership attributes associated with charismatic/values-based leadership, team-oriented leadership, and participative leadership.

Germanic Europe cluster. The countries composing the Germanic Europe Cluster include (a) Austria, (b) Germany, (c) German-speaking Switzerland, and (d) Netherlands (House et al., 2014). GLOBE's aggregated results at the societal level of analysis evidence these countries most favor those leadership attributes associated with charismatic/values-based leadership, participative leadership, and team-oriented leadership (Chhokar et al., 2007).

Latin Europe cluster. The countries composing the Latin Europe Cluster include (a) France, (b) Israel, (c) Italy, (d) Portugal, (e) Spain, and (f) French-speaking Switzerland (House et al., 2014). GLOBE's aggregated results at the societal level evidence these countries favor those leadership attributes associated with team orientation and charismatic/values-based leadership (Chhokar et al., 2007).

Latin America cluster. The countries composing the Latin America Cluster include (a) Argentina, (b) Bolivia, (c) Brazil, (d) Columbia, (e) Costa Rica, (f) Ecuador, (g) El Salvador, (h) Guatemala, (i) Mexico, (j) Peru, and (k) Venezuela (House et al., 2014). GLOBE's aggregated results at the societal level of analysis evidence these countries favor those leadership attributes associated with charismatic/values-based leadership and team orientation (Chhokar et al., 2007).

Eastern Europe cluster. The countries composing the Eastern Europe Cluster include Albania, Azerbaijan, Estonia, Georgia, Greece, Hungary, Kazakhstan, Poland, Romania, Russia, and Slovenia (House et al., 2014). GLOBE's aggregated results at the societal level of analysis evidence these countries favor those leadership attributes associated with team-oriented leadership and charismatic/values-based leadership (Chhokar et al., 2007).

Middle East cluster. The countries composing the Middle East Cluster include (a) Egypt, (b) Kuwait, (c) Morocco, (d) Qatar, and (e) Turkey (House et al., 2014). GLOBE's aggregated results at the societal level of analysis evidence these countries favor those leadership attributes

associated with charismatic/value-based leadership and team-oriented leadership (Chhokar et al., 2007).

Confucian Asia cluster. The countries composing the Confucian Asia Cluster include (a) China, (b) Hong Kong, (c) Japan, (d) Singapore, (e) South Korea, and (f) Taiwan (House et al., 2014). GLOBE's aggregated results at the societal level of analysis evidence these countries favor those leadership attributes associated with charismatic/values-based leadership, team-oriented leadership, humane oriented leadership, and participative leadership (Chhokar et al., 2007).

Southern Asia cluster. The countries composing the Southern Asia Cluster include (a) India, (b) Indonesia, (c) Iran, (d) Malaysia, (e) Philippines, and (f) Thailand (House et al., 2014). GLOBE's aggregated results at the societal level of analysis evidence that these countries favor leadership attributes associated with charismatic/values-based leadership, team-oriented leadership, autonomous leadership, and (self-protective leadership (Chhokar et al., 2007).

Sub-Saharan Africa cluster. The countries composing the Sub-Saharan Africa Cluster include (a) Nambia, (b) Nigeria, (c) South Africa Black Sample, and (d) Zimbabwe (House et al., 2014). GLOBE's aggregated results at the societal level of analysis evidence these countries favor those leadership attributes associated with charismatic/values-based leadership, team-oriented leadership, and participative leadership (Chhokar et al., 2007).

Anglo cluster. The countries composing GLOBE's Anglo Cluster include (a) Australia, (b) English-speaking Canada, (c) England, (d) Ireland, (e) New Zealand, and (f) South Africa White Sample. GLOBE's aggregated results at the societal level of analysis suggest that individuals originating from these countries favor those leadership attributes associated with

charismatic/values-based leadership, team-oriented leadership, and participative leadership (Chhokar et al., 2007).

GLOBE's 112 leadership scales were applied in the U.S. to 382 middle managers working in telecommunications, financial services, and food processing organizations. The attributes with the highest means scores viewed as contributing to outstanding leadership were those associated with GLOBE's primary CLT dimensions of (a) performance orientation, (b) integrity, (c) inspiration, (d) vision, (e) team integration, (f) decisiveness, (g) administrative competence, (h) diplomacy, and (i) team collaboration (House et al., 2014; see Table C1).

Time worked in the U.S and U.S. STEM. Culture and its resulting values may occur at an organizational level (Hofstede et al., 2010). As highlighted earlier in this literature review, foreign-born workers comprised approximately 26.5% of the population within the business and industry sector. U.S. STEM foreign-born workers come to the United States for different reasons and durations. Approximately 35% of foreign-born, non-U.S. citizens who work in the U.S. STEM occupations within business and industry reported that they came to the U.S. for family-related reasons. Other primary reasons for coming to the U.S. included education opportunities at about 22.2% and job opportunities at about 22%. Only 4% reported that their primary reason coming to the U.S. was due to scientific or professional infrastructure (NSF, 2017).

Time worked in the U.S. is a potential indicator of *acculturation*. Different outcomes result from prolonged residency in the U.S. For example, prolonged residency may produce the effect of acculturation (Berry, 2008). Acculturation can produce the homogenization of cultures and values (Gonzalez-Loureiro, Kiessling, & Dabic, 2015). Alternatively, STEM workers who originate from other countries may instead adopt coping mechanisms and cultural learning strategies such as those strategies a tourist would adopt in a host country (Ward, 2008).

Depending on the degree of time spent in both the home country and the U.S., U.S. STEM workers may achieve the ability to adapt differently and appropriately in both cultures, adopting a global mindset (Bird & Mendenhall, 2016; Gonzalez-Loureiro et al., 2015).

Formally, the four types of acculturation that occur are (a) integration, (b) assimilation, (c) separation, and (d) marginalization. First, integration allows the individual to maintain his/her cultural identity and at the same time integrate with the new culture by switching between cultural frames. An individual's success in switching between cultural frames is related to the concept of cultural intelligence. Second, assimilation is a complete departure from integration. Assimilation requires individuals to release their cultural identities and instead embrace the cultural identity of the new environment. Third, separation is the opposite of assimilation in that an individual would hold to his/her cultural identity and separate from the new culture. Marginalization, a fourth approach to acculturation, dilutes both cultural identities. The implication to views of outstanding leadership is that more distinct aspects of culture and values can be marginalized given extended time in the U.S. Integration or biculturalism allows an employee to maintain his/her unique cultural identity. Integration is considered the optimal approach to acculturation. The implication for leadership is that leaders with high degrees of adaptability to different cultures may be viewed as more effective (Gonzalez-Loureiro et al., 2015).

Workforce category and U.S. STEM. Culture and its resulting values may occur at a social class, occupational, or professional level (Hofstede et al., 2010). Managers and non-managers in U.S. STEM may evidence differing views of outstanding leadership. The NSF (2017) estimated that there were 901,640 managers across all U.S. STEM occupations with 709,194 managers within business and industry (see Table 2). This management population

encompassed an estimated 28% women (see Table 3). Jobs within U.S. STEM management occupations are projected to grow 9.9% with higher growth of 12.0% in computer and information systems management jobs (2016-2026 U.S. employment projections, 2017, October; see Table 1). STEM evolved as independent disciplines in universities for the most part (Walls, 2000). Today, the U.S. education system endeavors to deliver an integrated STEM education that recognized interdependencies in science, technology, engineering, and mathematics disciplines. Additionally, there is increasing emphasis on creating learning experiences rooted in real-world contexts in STEM education. Integration of the technical aspects of the STEM disciplines has been described as a "confusing landscape" that requires common vocabulary and framework (Committee on Integrated STEM Education et al., 2014, p. 2).

STEM organizations have suffered from a leadership shortage among technical experts raised in previous generations that focused on technical excellence and scholarship. U.S. STEM technical experts moving to positions of leadership have faced challenges growing into a set of responsibilities focused on managing people and organizations where leaders must rely on soft skills (Eiser, 2008; Patterson, 2015). New contexts for leadership in STEM are emerging (Hartmann & Jahren, 2015). Transitioning from technical leadership to strategic leadership of teams requires a shift in mindset (McAlpine, 2016). The literature describes anthropological and ethnographical implications of culture in U.S. STEM (Bainbridge, 2012). Newer efforts are consulting learning sciences, educational psychology, and even cognitive psychology to understand the criticality of connected knowledge structures that better equip learners to apply integrated learning in unfamiliar contexts (Committee on Integrated STEM Education et al., 2014).

The introduction of integrating concepts, such as connected knowledge structures, may inspire integration of leadership into core STEM curriculum. Technical experts must be able to evolve and acquire competencies such as shaping organizational culture, building an adaptive team, and investing more in others' successes and accomplishments over one's own achievements. Technical experts must practice self-awareness and self-management to evolve as role models of the leadership behaviors and values of the organization. These attributes contribute to a leader becoming viewed as more strategic (Patterson, 2015).

The implication for leadership is that individuals who work in senior management and raised in a generation that favored technical excellence may favor technical aspects of leadership. Alternatively, individuals with fewer years of U.S. STEM management may favor social and adaptive leadership behaviors for building teams and dealing with different cultures. Shifting demographics U.S. STEM demographics require that leaders must develop cultural intelligence and a global mindset (Javidan & Bowen, 2013).

Summary Table of the Literature

Table 6

Summary Table of the Literature

Topic	Search Strategy	Dates	Findings Snapshot
Data sources	Pepperdine libraries: 18+ electronic databases; YouTube; search engines; Google Scholar, National Archives, U.S. Dept. of Labor; National Science Foundation; U.S. Census Bureau; Federal Register, Digital Commons, Whitehouse.gov, NSF.gov; census.gov, SHRM.org, and more.	1700 - 2018	Four primary STEM data sources: U.S. Dept. of Labor U.S. Census Bureau Current Population Survey U.S. Census Bureau American Community Survey
U.S. STEM History	Science, technology, engineering, mathematics; S&E, SMET, and STEM	1700 - 2018	STEM acknowledged in first State of the Union address SMET as reference collective disciplines emerged in 1993 STEM short 1,000,000 workers 2014-2024 in some STEM skills Aggressive educational reform, recruiting, and other initiatives targeting women, underrepresented minorities, K-12 and college students, and foreign-born workers

(continued)

GLOBE Model and Leadership Scales	GLOBE and House, GLOBE Study or GLOBE project	ALL	Links culture, leadership and organization practices GLOBE leadership scales compiled similar to other ILT scales Retained 112 scales exhibited measurement equivalence across most societies Leadership scales applied in 67 societies Leadership scales applied in telecommunications Twenty-two of 112 leadership attributes were universally endorsed as positive
Implicit Leadership Theory	Culturally endorsed implicit leadership theory; and implicit leadership theory	1945 - 2018	Societal culture and personal histories affect views of outstanding leadership
Women in U.S. STEM	Science, technology, engineering, mathematics; S&E; SMET; STEM; education; and women	1970 - 2018	Underrepresented in STEM education and STEM fields Special emphasis on recruiting arising in 1970s and still ongoing Numbers and percentages increasing Women represent 25% of STEM workforce Gender influences views of leadership
Age and U.S. STEM	Science, technology, engineering, mathematics; S&E; SMET; STEM; education; age; K-12; generation; generational; baby boomer; generation x, generation Y, and millennial	1970 - 2018	U.S. education deficiencies arose in the early 1980s Special emphasis on recruiting ongoing Demographic shift to replace retiring baby boomers More generations in today's workplace STEM technical leadership has evolved past siloed disciplines toward interdependencies STEM leadership encompasses soft skills Generation influences views of leadership
Nationality and Culture	STEM and immigration, STEM and foreign-born	1970 - 2018	STEM reliance on foreign born workers arose in 1990 Special emphasis on recruiting ongoing Numbers and percentages are increasing Culture influences views of leadership
Time worked in U.S.	Acculturation or U.S. acculturation; and acculturate	1970 - 2018	Time increases homogenization of culture and values Duration foreign-born workers remain in the U.S. is increasing Time worked in the U.S. influences views of leadership
Management Status and U.S. STEM	Management; STEM manage; STEM management	1970 - 2018	U.S. STEM management deficiencies arising from focus on technical excellence alone Special emphasis on recruiting ongoing Demographic shift to replace retiring baby boomers More generations in today's workplace STEM technical leadership has evolved past siloed disciplines toward interdependencies STEM leadership encompasses soft skills Management status influences views of leadership

Conclusion

Commager (1961) suggested that when America's history is studied in a vacuum or isolation, it is easy to exaggerate differences and minimize similarities between the past and present times. Consider that America's founders were, by many measures, similar to today's STEM leaders. America's first outstanding leaders came to America from other countries. America depended on the inventions of other countries and faced global competition. Further, prevailing preferences for leadership attributes determined who Americans chose to lead the country and its institutions. Every outcome in new America depended on invention and

leadership. Commager's description of the founding of America is similar to today's pursuits of survival and sustainability in U.S. STEM.

The literature demonstrates that U.S. STEM has experienced a constant state of evolution and transformation since the founding of the nation. In this sense, there are many lenses through which to examine leadership in U.S. STEM. First and most importantly, STEM leadership refers to the individual imaginations and inventions that are at the core of any nation's competitiveness, national security, and economic success. Second, STEM leadership is the ability of the U.S. education system and U.S. government and to design policies, systems, and methods that attract and facilitate imaginations. This third lens is the ability of leaders in organizations to inspire and motivate individuals and team to contribute to the success of the organization. The purpose of this literature review was to examine U.S. STEM leadership through this third lens.

Section one explored the history and current state of STEM. America's success in STEM depends on outstanding STEM leadership, in addition to technical accomplishments. Aggressive educational reform and recruiting efforts will produce an increasingly cross-cultural workforce in U.S. STEM. Section two explored GLOBE, which has produced a framework to consider the interplay of culture, leadership, and organizational effectiveness. Section three explored ILT and implications for views of outstanding leadership. Section four examined factors contributing to the increasingly cross-cultural U.S. STEM workplace, as well as implications for leadership.

America's global competitiveness, economic success, and national security depend on America's success in STEM (Beede et al., 2011; Carnevale et al., 2011; Executive Office of the President of the United States, 2013; National Science Board, 2018a; STEM Education Act of 2015, 2015; U.S. Department of Education, 2015; Vilorio, 2014). Given challenges in U.S.

STEM, implications of ILT, and shifting demographics, it is appropriate that research is conducted to explore the views of outstanding leadership among the U.S. STEM workforce.

Chapter Three: Methods

This study surveyed the views of outstanding leadership among the U.S. STEM workforce. This chapter presents the methods that were used to answer the research questions for the current study. The sections in this chapter include: (a) restatement of research questions and hypotheses; (b) description of the research methodology, including definition of the data source and the analysis unit; (c) process for selection of data sources; (d) definition of data gathering instruments; (e) validity of data gathering instrument; (f) reliability of data gathering instrument data gathering procedures; (g) data gathering procedures; (h) description of proposed data analysis processes; (i) sample tables for proposed data analysis; and (i) Institutional Review Board (IRB).

Restatement of Research Questions and Hypotheses

1. Which of the 112 leadership attributes are viewed as contributing to outstanding leadership among U.S. STEM workers in business and industry?
2. How are the views of the 112 leadership attributes related to gender?
    a. Null 2. None of the views of the 112 leadership attributes are related to gender.
    b. Alternative 2. At least one of the views of the 112 leadership attributes is related to gender.
3. How are the views of the 112 leadership attributes related to age?
    a. Null 3. None of the views of the 112 leadership attributes are related to age.
    b. Alternative 3. At least one of the views of the 112 leadership attributes is related to age.
4. How are the views of the 112 leadership attributes related to national origin group?

   a. Null 4. None of the views of the 112 leadership attributes are related to national origin group.
   b. Alternative 4. At least one of the views of the 112 leadership attributes is related to national origin group.

5. How are the views of the 112 leadership attributes related to number of years worked in the United States?
   a. Null 5. None of the views of the 112 leadership attributes are related to number of years worked in the United States.
   b. Alternative 5. At least one of the views of the 112 leadership attributes is related to number of years worked in the United States.
6. How are the views of the 112 leadership attributes related to workforce category?
   a. Null 6. None of the views of the 112 leadership attributes are related workforce category.
   b. Alternative 6. At least one of the views of the 112 leadership attributes is related to workforce category.

Description of the Research Methodology

The quantitative, relational study measured the degree to which members of the U.S. STEM workforce perceive each of 112 leadership attributes as either inhibiting or contributing to outstanding leadership, by applying the Globe Research Survey Form Beta, sections two and four, a self-report questionnaire (see APPENDIX A). Given the increasingly cross-cultural U.S. STEM workforce, there are benefits to understanding the degree to which certain leadership attributes may be universally endorsed, and the degree to which these attributes may be viewed as either inhibiting or contributing to outstanding leadership in U.S. STEM. The GLOBE

leadership scales were selected as the most reliable instrument for collecting study participants' self-reports, based on the approach to developing the scales. The scales represent multiple theories and constructs in leadership literature (House & Aditya, 1997). Further, the scales were translated and back-translated into multiple languages. The 112 individual scale items that were eventually retained were those that exhibited measurement equivalence across most societies (Hanges & Dickson, 2004). Details regarding the GLOBE instrument are discussed later in this chapter.

Data sources. The data source for this study was the self-report responses of individuals working in STEM occupations (see APPENDIX L) and STEM-related occupations (see APPENDIX M) within the U.S. and within the business and industry sector. Self-report responses were collected utilizing to the GLOBE Research Survey Form Beta, sections two and four (see APPENDIX A). The survey measured study participants' views of outstanding leadership through presentation of 112 leadership attributes and behaviors, measured on an ordinal 7-point Likert-type scale.

First, by adopting a descriptive design, this study described which leadership attributes are expected to be universally endorsed as either inhibiting or contributing to outstanding leadership. This was accomplished through aggregation of the mean scores of study participants for each of 112 individual leadership attributes. Next, adopting a correlational design, this study explored which statistically significant positive or negative relationships existed, if any, between study participants' views toward 112 individual leadership attributes and five independent variables: (a) gender, (b) age, (c) number of years worked in the U.S., (d) national origin group, and (e) workforce category. To accomplish this, the data were collected, treated as ordinal, and analyzed utilizing a correlational approach. Specifically, gender was collected via a dichotomous,

single option survey question and then treated as an ordinal variable. Age and number of years worked in the U.S. were collected via discrete, fixed value survey questions and then treated as ordinal variables. Regarding national origin group, first, national origin was collected via a nominal, single-option survey question. Next, national origin was aggregated to correspond to a national origin group, either Anglo or non-Anglo. National origin group was treated as an ordinal variable. Workforce category was collected via a nominal, single-option survey question. The leadership categories ranged in degree of responsibility and were treated as ordinal. Study participants were recruited beginning in November of 2016. Data collection was cross-sectional to capture study participants' views at a point in time.

Definition of the Analysis Unit

The analysis unit was an individual with four characteristics. First, the study participant was 18 years of age or older. Second, the study participant was employed as a STEM professional (see APPENDIX L) or STEM-related technician, technologist or manager (see APPENDIX M) in one of three occupation groups, either: (a) computer, information, and mathematical sciences; (b) life, physical sciences, and social sciences; or (c) engineering. Third, the study participant was employed within the business and industry sector. Fourth, the study participant had a current primary work country in the United States.

Individuals under 18 years of age were excluded from participation. The following occupation groups were excluded occupation: (a) post-secondary academic teaching occupations, (b) health-related occupations, and (c) all other occupation groups not listed in the preceding paragraph. Individuals employed in either government or academic employment sectors were excluded from participation. Individuals whose current primary work country was outside the U.S. were excluded from participation.

Sampling method. The sampling for this study was non-probabilistic. Non-probabilistic sampling is useful in cases when obtaining a comprehensive list of potential study participants is prohibitive, or the population is not well defined (Battaglia, 2008), such as in the case of U.S. STEM. Self-selection allowed potential study participants to elect study participation through survey completion or implicitly decline study participation through non-response (Sterba & Foster, 2008).

Sample. According to the latest estimates by the NSF (2017), the population of U.S. STEM workers in the business and industry sector is approximately 5.5 million (see Table 2). The G*Power 3.1 software program (Faul, Erdfelder, Buchner, & Lang, 2009) was used to determine the needed sample size for linear regression (Pearson correlations). Given one independent variable (either gender, age, national origin group, number of years worked in the U.S., or workforce category), based on a medium effect size ($f2 = .15$) and an alpha level of $\alpha = .05$, the needed sample size to achieve sufficient power (.80) was 55 respondents). However, this study used Spearman's correlations due to the ordinal nature of the dependent variables, and G*Power does not provide power calculations for non-parametric statistics. Lehmann (1998) suggested adding 15% to the equivalent parametric statistic power analysis. With that, the necessary sample needed for sufficient power was 63 respondents (see Figure 3).

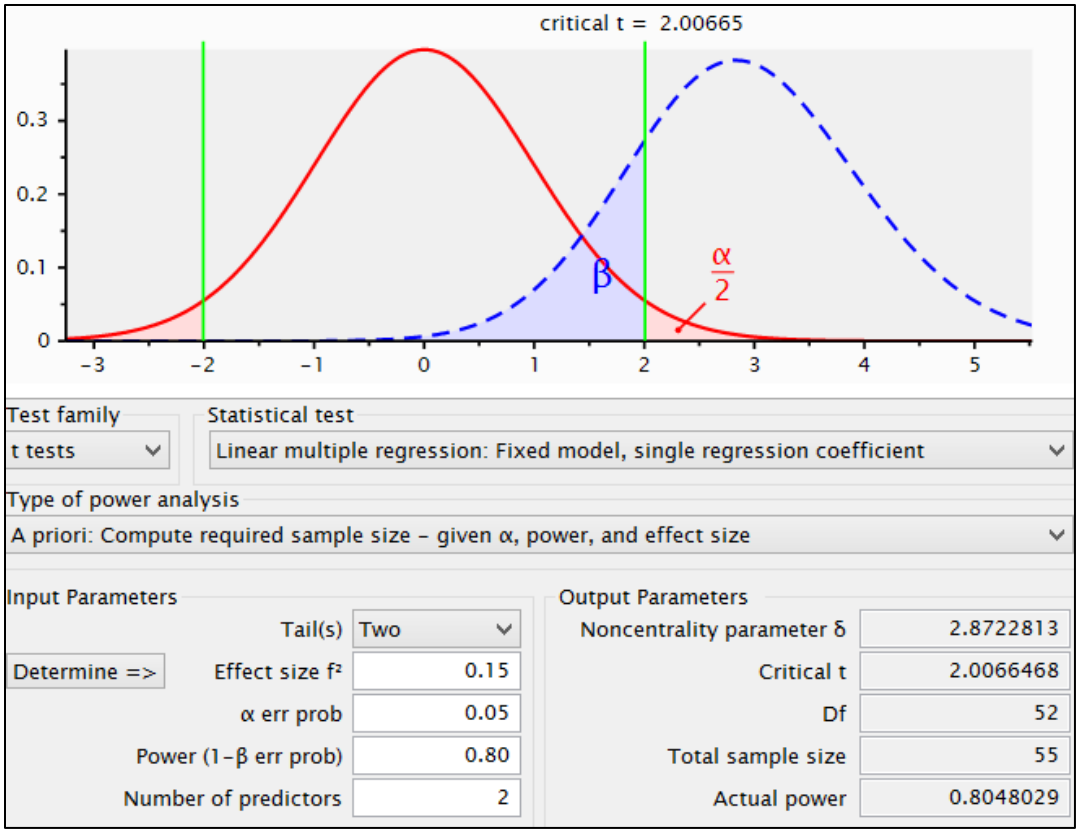


Figure 3. G*Power calculation sample size. From G*Power Version 3.1.9.2 [Computer software]. (2014). Reprinted with permission.

This study anticipated a 25% voluntary response rate and, therefore, the researcher ensured a sampling frame of no fewer than 252 potential study participants composed of individuals working in U.S. STEM occupations within the business and industry sector. A sampling frame of approximately 750 was anticipated. Non-response was addressed through follow-up communication requesting survey participation.

Process for Selection of Data Sources (Study Participants)

The researcher drew from public contact information and the researcher's personal contact database to make telephone and email contact with organizations, associations, and individuals with known associations to U.S. STEM in the business and industry sector. The procedure used to draw the sample from the sampling frame included three elements. First, the researcher made direct contact by telephone or by email (see APPENDIX O). Second, if the

researcher successfully secured access to membership base in an organization or association, the researcher provided the organization or association with a sample communication for their members (see APPENDIX P). As might have been required by individual study participants, the researcher obtained permission from the organization's or association's authorized organization representative to conduct data collection. Third, in the event of low response, below 63 study participants, the researcher had the option to contract with a third-party service to recruit additional study participants to attempt a minimum sample of 63 participants.

Definitions of Data Gathering Instruments

The primary measurement instrument used in this study was a five-part electronic survey. The GLOBE Research Survey Form Beta, sections two and four, consists of the GLOBE leadership scales (see APPENDIX A). The GLOBE leadership scales were produced and piloted in GLOBE phase one. GLOBE phase two applied the scales to survey more than 17,300 middle managers across 61 countries within three industries. The instrument was composed of 112 scale items representing leadership attributes, behaviors, and characteristics (attributes) drawn from a comprehensive survey of leadership literature and concepts (House & Aditya, 1997). The instrument measured study participants' values or what *should be* of leadership attributes on a 7-point Likert-type scale that ranged from *greatly inhibits* to *greatly contributes to* outstanding leadership. For this study, the GLOBE leadership scales were adapted for electronic delivery (see APPENDIX Q).

A secondary measurement instrument was used after the conclusion of the study. The secondary measure instrument, created by the researcher, was composed of a single open-ended question in a separate database. The instrument collected the study participants' email addresses

to participate in a drawing for a $500 Amazon gift certificate (see APPENDIX R). A visual depiction of the survey experience is illustrated in Figure S1 (see Appendix S).

Validity of Data Gathering Instruments

Regarding the validity of self-report surveys, responses to survey questions may be affected by self-presentation bias that causes survey participants to exaggerate based on social factors. The researcher motivated truth-telling through assurance of anonymity.

Parts two and three of the data-gathering instrument consisted of standard demographic variables in common use. To address threats to validity, the researcher consulted the literature and similar studies regarding the final question design.

Part four of the data gathering instrument applied the GLOBE leadership scales from the GLOBE Research Survey Form Beta, sections two and four (see APPENDIX A). The GLOBE leadership scales are composed of traits and behaviors with accompanying definitions, similar to other instruments that measure ILTs. The multi-level structure of the leadership scales (see APPENDIX C) was produced with the intent of measuring and comparing groups at the organizational or societal level of the analysis. Although psychometric properties at the individual level of analysis are unknown, ILT, which underpins the GLOBE project, is an individual-focused theory. GLOBE acknowledged the potential usefulness of the 112 scale items for measuring ILTs at the individual level of analysis (GLOBE Foundation, 2006b).

The 112 GLOBE leadership scales were selected based on the cross-societal rigor applied in their development. To develop the 112 leadership scale items, 382 leadership scale items were assembled from a comprehensive set of leader attributes and behaviors drawn from multiple leadership theories (House & Aditya, 1997). A pilot study collected survey data from 1,943 study participants in multiple countries. The pilot studies utilized a split sample approach to data

validation. Focus groups were conducted. New leadership attributes were added to address cultural factors beyond westernized leadership bias. Scale items underwent translation into multiple languages, back translation, and revision to ensure that the concepts were translated sufficiently across various languages and cultures. In-country investigators who were familiar with the societal cultures facilitated in-country activities (Hanges & Dickson, 2004, 2006).

Through Q-sorting, item analysis, translation, and back translation, the number of leadership scale items were reduced to 112 items. For example, problematic scale items related to language translation or cultural inappropriateness were dropped or rewritten. The retained scale items exhibited measurement equivalence across many societies (Hanges & Dickson, 2004, 2006). The GLOBE Research Survey was delivered successfully to more than 17,300 individuals across the globe, including telecommunications professionals in the U.S (House et al., 2014).

The GLOBE team grants any researcher permission to use the leadership scales with a caution regarding the selected unit of analysis and study design (see APPENDIX I). Characterizations of culture cannot be made at an individual level of analysis (GLOBE Foundation, 2006b; Hofstede, 1995).

Reliability of Data Gathering Instrument Data Gathering Procedures

To ensure the reliability of the researcher-created instrument, the researcher adhered to the guidance provided by GLOBE subject matter experts, the researcher's chairperson, and committee members for this study. GLOBE assumed an average of 45 responses for each society or organization.

Description of Data Analysis Processes

Incoming coded data from the selected survey host, Qualtrics, was exported into a Microsoft Excel spreadsheet. The data were imported into Statistical Package for Social Sciences

(SPSS) Statistics (IBM Corp., 2014). Although direct import prevented errors, spot-checking additionally ensured that both export and import of the data occurred with accuracy, completeness, and readability.

Data resulting from the individual surveys were aggregated for analysis as one population and at the individual level of analysis. First, general demographics and distributions were analyzed. Means, standard deviations, and ranges were determined. Descriptive statistics were utilized to present the findings in a manageable format. Tables were used to establish visibility of demographic distributions dispersion for (a) gender, (b) age, (c) time worked in the U.S., (d) national origin group, and (e) workforce category.

If a monotonic relationship existed, Spearman's correlation was used to determine the statistical significance of each correlation. Results were ranked from high to low to determine the leadership attributes universally endorsed as contributing to outstanding leadership. The results were ranked from low to high, to determine the leadership attributes most universally endorsed as inhibiting outstanding leadership. The results were presented in table form.

The purpose of this phase of the analysis was to identify patterns, not individual preferences (Bentz & Shapiro, 1998). Only those findings with statistical significance, positive or negative, were reported. Spearman is a non-parametric statistical method. Non-parametric measures are utilized when data is not normally distributed. Non-parametric approaches are useful when correlating culture-related data for which moderating variables have not been isolated. Using Spearman correlations required that the data be treated as ordinal (Kraska-Miller, 2014).

Table 7

Research Design

Survey Part	Subscale	Question Description	Measurement	Survey Question
Survey One Part One: Informed Consent and Age Acknowledgement	N/A	Read Informed Consent	N/A	N/A
	First	Do you consent to the above terms, attest you are 18 years or older, and elect to continue to the survey? (a) Yes, continue to the survey (b) No, end the survey (survey ends)	Categorical, nominal	Dichotomous, single option
Survey One Part Two: Screening Questions	Second	What is your primary work country? This is the country where you work a majority of the time during an average work week. A) United States B) Other country (survey ends)	Categorical, nominal	Dichotomous, single option
	Third	What is your work sector? (A) Business and industry (includes private and public non-profit) (b) Academia (survey ends) (c) Government (survey ends)	Categorical, nominal	Single option
	Fourth	What is your occupation group? (a) Computer, information technology or information sciences occupations (includes technicians, technologists and managers) (b) Life sciences, physical sciences or social sciences occupations (includes technicians, technologists and managers; and EXCLUDES health occupations) (c) Engineering occupations (includes technicians, drafters and managers) (d) Other occupations (includes architecture, health and all other occupations) (survey ends)	Categorical, nominal	Single option
Survey One Part Three: Demographic Questions	Fifth	What is your gender? (a) female (b) male	Categorical, nominal; treated as ordinal	Dichotomous, single option
	Sixth	What is your age in years? Enter 18 to 99 years in whole numbers.	Continuous, ratio; treated as ordinal	Discrete fixed value
	Seventh	What is your national origin or the country where you most affiliate? This is either the country of your citizenship/passport or the country with which you most identify. If the country is not listed, you may exit the survey.	Categorical, nominal; assigned to cluster and treated as ordinal	Selection box, single option
	Eighth	How many years have you worked in the United States? Enter 0 to 99 years in whole numbers.	Continuous, ratio; treated as ordinal	Discrete fixed value
	Ninth	What is your workforce category? (a) Individual contributor without direct reports (b) First-level manager or supervisor with direct reports (c) Mid-level manager with direct reports (d) Executive/top-level manager with direct reports	Categorical, nominal; treated as ordinal	Single option
Survey One Part Four: Leader Behaviors	N/A	Read instructions	N/A	N/A
	Tenth	Rate the degree to which each behavior or characteristic either inhibits or contributes to outstanding leadership. 1. Inhibits greatly 2. Inhibits somewhat 3. Inhibits slightly 4. Has no impact 5. Contributes slightly 6. Contributes somewhat 7. Contributes greatly	Categorical, ordinal	Seven-point Likert-type scale
Survey One Part Five: Results	N/A	Read results	N/A	N/A
	Eleventh	Would you like to enter a drawing to win a $500 Amazon gift card? (a) Yes (b) No (survey ends)	Categorical, nominal, dichotomous	Single option
Survey Two Drawing	Twelth	You elected to enter a drawing to win a $500 Amazon gift certificate. Please provide an email address where you wish to be notified and provided instructions, if you win.	Categorical, nominal	Text field

Institutional Review Board

The researcher completed the mandated human subjects training through Collaborative Institutional Training Initiative (CITI; see APPENDIX T). Upon notification of successful completion, the researcher then proceeded with an application to the Institutional Review Board (IRB) of Pepperdine University.

Human subjects consideration. According to Section 45 CFR 46.101(b)(2) of the U.S. Department of Health and Human Services, it was anticipated that this study would meet the requirements for an exemption regarding protection of human subjects (see APPENDIX U). Participation in the survey was voluntary. First, the data collection method was a survey. Study participants had the option withdraw from the survey at any time, without consequence. The information sheet advised study participants of their ability to end their participation in the survey at any time, for any reason, and without any retaliation by exiting the survey (see APPENDIX Q).

This study surveyed individuals who were under 18 years of age. Individuals who were less than 18 years of age were ineligible for participation, without exception. The information sheet required that study participant acknowledge the requirement that study participants be 18 years of age or older before proceeding to the survey (see APPENDIX Q).

Participation in this study was anonymous. This study was hosted through Qualtrics, a third-party service provider. This study did not collect identifying information. Any potential digital identifiers in the data file to be analyzed were destroyed. The information sheet advised potential study participants of their ability to participate in the study anonymously (see APPENDIX Q). The primary risk to study participants was breach of confidentiality.

A second survey provided study participants the option to participate in a drawing for a $500 Amazon gift certificate. This second survey collected the study participants' email addresses (see APPENDIX R). Email addresses were collected and stored in a separate database that could not be traced to participant responses in the first survey. Upon issuance of the $500 gift certificate, email addresses were destroyed.

Additionally, this study anticipated minimal risks to study participants consisting of the study participant's time to participate in a survey and reflect on their views of outstanding leadership. Survey completion was expected to take approximately 20-30 minutes. Actual survey completion time was 15-20 minutes. Therefore, the study participant had the potential to experience rater fatigue, boredom, or loss of interest. Given the stated risks, the researcher submitted an application requesting exemption to the IRB at Pepperdine University. Exemption was subsequently granted (see APPENDIX V).

Chapter Four: Results

This study had two purposes. The first purpose was to understand which leadership attributes were viewed as contributing to or inhibiting outstanding leadership among the U.S. STEM workforce within business and industry. The second purpose was to identify what relationships existed, if any, between views of outstanding leadership and gender, age, national origin group, number of years worked in U.S., and workforce category. There were 151 participants in this study.

Recruitment of Participants

Adopting the NSF's (2017) most current dataset, the population of U.S. STEM workers in the business and industry sector is approximately 5.5 million (see Table 2). Given the G*Power 3.1 software program (Faul et al., 2009) and Lehmann's (1998) guidance for adding 15% to the equivalent parametric statistic power analysis, the required sample for sufficient power was established at 63 respondents.

The researcher accessed public contact information via the Internet and the researcher's personal contact database to identify organizations and individuals with known associations to U.S. STEM in the business and industry sector. The researcher made contact by telephone and email. In total, 750 individuals and 13 organizations were contacted with an invitation to participate in the study (see APPENDIX O). As required by participating organizations, the researcher obtained permission to collect data from the organization's authorized representative. The researcher provided a sample communication that was modified by the organization (see APPENDIX P).

The sampling for this study was non-probabilistic because obtaining a comprehensive list of potential study participants was prohibitive (Battaglia, 2008). Self-selection allowed potential

study participants to elect to participate through survey completion or decline study participation implicitly through non-response (Sterba & Foster, 2008). The study was anonymous and identifiable information was not collected.

Participation

There were three organizations that published information about the opportunity to participate in the survey through internal communications or social media, reaching both members and non-members, resulting in an unknown sampling frame and inhibiting the calculation of a return rate. In total, 151 individuals completed the study. This section displays the frequency counts for independent variables. The majority of the study participants were male (73.5%; see Table 8).

Table 8

Frequency Counts for Independent Variables, Gender (N = 151)

Variable	*n*	%
Male	111	73.5
Female	40	26.5

The ages of the study participants ranged from 22 to 71 years (M = 47.07, SD = 10.74). The ages of study participants were separated by decade and by generation. When the ages were separated by decade, most of the study participants were between the ages of 50 and 59 (37.7%) or 40 and 49 (27.8%). When the study participants were separated by generation, the majority were categorized as Generation X (born 1965 to 1976; 39.7%; see Table 9).

Most of the study participants originated from countries associated with the Anglo national origin group (78.8%; see Table 10). Years worked in the U.S. ranged from less than 1 year to 51 years (M = 26.32, SD = 11.75; see Table 11). The study participants were most often individual contributors (53.6%) in the workforce (see Table 12). Study participants were most

often categorized within the computer, information sciences or mathematical occupations (64.2%; see Table 13).

Table 9

Frequency Counts for Independent Variables, Age (N = 151)

Variable	*n*	%
Age by decade [a]		
22-29	15	9.9
30-39	22	14.6
40-49	42	27.8
50-59	57	37.7
60-69	14	9.3
71 and over	1	0.7
Age by generation [a]		
Generation Z (1994 to present)	1	0.7
Millennials (1977-1993)	38	25.2
Generation X (1965-1976)	60	39.7
Late Baby Boomers / teens of the 1970s (1955-1964)	44	29.1
Early Baby Boomers / teens of the 1960s (1946-1954)	5	3.3

Note. [a]Actual age*: M* = 47.07, *SD* = 10.74.

Table 10

Frequency Counts for Independent Variables, National Origin Group (N = 151)

Variable	*n*	%
Middle East	1	0.7
Eastern Europe	2	1.3
Confucian Asia	8	5.3
Southern Asia	4	2.6
Latin Europe	3	2
Latin America	2	1.3
Germanic Europe	2	1.3
Other location [a]	10	6.6
Anglo	119	78.8

Note. [a]Ten respondents reported their country as "other." Lacking information as to the extent their societal culture was similar or different from the United States, a decision was made to place those ten respondents as close to the median as possible.

Table 11

Frequency Counts for Independent Variables, Number of Years Worked in the United States (N = 151)

Variable	n	%
0 to 9	18	11.9
10 to 19	24	15.9
20 to 29	34	22.5
30 to 39	53	35.1
40 to 49	20	13.2
50 to 51	2	1.3

Note. [a]Actual age: M = 47.07, SD = 10.74. [b]Ten respondents reported their country as "other." Lacking information as to the extent their societal culture was similar or different from the United States, a decision was made to place those 10 respondents as close to the median as possible. [c]Years Worked in the United States: M = 26.32, SD = 11.75.

Table 12

Frequency Counts for Independent Variables, Workforce Category (N = 151)

Variable	*n*	%
Individual contributor	81	53.6
First-level manager	15	9.9
Mid-level manager	28	18.5
Executive/top-level manager	27	17.9

Note. [a]Actual age: *M* = 47.07, *SD* = 10.74. [b]Ten respondents reported their country as "other." Lacking information as to the extent their societal culture was similar or different from the United States, a decision was made to place those 10 respondents as close to the median as possible. [c]Years Worked in the United States*: M* = 26.32, *SD* = 11.75.

Table 13

Frequency Counts for Occupation Group

Variable	*n*	%
Occupation Group		
Computer, information sciences or mathematical occupations (includes technicians, technologists, and managers/executives)	111	73.5
Life sciences, physical sciences or social sciences occupations (includes technicians, technologists and managers/executives)	40	26.5
Engineering occupations (includes technicians, drafters and managers/executives)	15	9.9

Note. N = 151.

Answering the Research Questions

Research question one. Research question one asked, *which of the 112 leadership attributes are viewed as contributing to outstanding leadership among U.S. STEM workers in business and industry?* To answer this question, Table 14 displays the descriptive statistics for the leadership scale items sorted by highest and lowest means. These ratings were given using a 7-point metric: 1 = *Inhibits Greatly* to 7 = *Contributes Greatly*. The highest rated attribute was for Item 16, *Trustworthy = Deserves trust, can be believed and relied upon to keep his/her word* (*M* = 6.81). The second highest rated attribute was for Item 22, *Clear = Easily understood* (*M* = 6.65). The third highest rated attribute was for Item 15, *Sincere = Means what he/she says, earnest* (*M* = 6.62). The fourth highest rated attributed was for Item 12, *Inspirational = Inspires*

emotions, beliefs, values, and behaviors in others (*M* = 6.60). The fifth highest rated attribute was for Item 1, *Diplomatic = Skilled at interpersonal relations, tactful* (M = 6.60).

The lowest rated attribute was for Item 105, *Dishonest = Fraudulent, insincere* (*M* = 1.15). The second lowest rated attribute was for *Hostile = Actively unfriendly, acts negatively toward others* (*M* = 1.16). The third lowest rated attribute was *Vindictive = Vengeful; seeks revenge when wronged* (*M* = 1.25). The fourth lowest rated attribute was *Tyrannical = Acts like a tyrant or despot; Imperious* (*M* = 1.34). The fifth lowest rated attribute was *Non-cooperative = Unwilling to work jointly with others* (*M* = 1.37).

Table 14

Descriptive Statistics of the Leadership Scale Items Sorted by Five Highest and Five Lowest Means (N = 151)

Item	*M*	*SD*
Five highest rated attributes		
16. Trustworthy = Deserves trust, can be believed and relied upon to keep his/her word	6.81	0.55
22. Clear = Easily understood	6.65	0.61
15. Sincere = Means what he/she says, earnest	6.62	0.72
12. Inspirational = Inspired emotions, beliefs, values, and behaviors in others, inspires others to be motivated to work hard	6.6	0.74
1. Diplomatic = Skilled at interpersonal relations, tactful	6.6	0.8
Five lowest rated attributes		
105. Dishonest = Fraudulent, insincere	1.15	0.59
106. Hostile = Actively unfriendly, acts negatively towards others	1.16	0.55
50. Vindictive = Vengeful; seeks revenge when wronged	1.25	0.65
24. Tyrannical = Acts like a tyrant or despot; Imperious	1.34	0.86
63. Non-cooperative = Unwilling to work jointly with others	1.37	0.64

Note. The scales were based on a 7-point metric: 1 = Greatly Inhibits to 7 = Greatly Contributes.

Research question two. Research question two asked, *how are the views of the 112 leadership attributes related to gender?* The alternative hypothesis stated, *at least one of the views of the 112 leadership attributes is related to gender*, and the related null hypothesis stated, *none of the views of the 112 leadership attributes are related to gender*.

To answer this question, Table 15 and Table 16 display the Spearman-Rho correlations between leadership attributes and gender. Cohen (1988) suggested some guidelines for

interpreting the strength of linear correlations. He suggested that a weak correlation typically had an absolute value of $r = .10$ (about 1% of the variance explained), a moderate correlation typically had an absolute value of $r = .30$ (about 9% of the variance explained) and a strong correlation typically had an absolute value of $r = .50$ (about 25% of the variance explained). For the sake of parsimony, this Results Chapter will primarily highlight those correlations that were at least of moderate strength to minimize the potential of numerous Type I errors stemming from interpreting and drawing conclusions based on potentially spurious correlations.

Of the five largest correlations, three were associated with male respondents. Males gave higher ratings for (a) Item 74, *Self-effacing = Presents self in a modest way* ($r_s = -.26$, $p = .001$); (b) Item 86, *Self-sacrificial = forgoes self-interests and makes personal sacrifices in the interest of a goal or vision* ($r_s = -.25$, $p = .002$); and (c) Item 20, *Just = Acts according to what is right or fair* ($r_s = -.20$, $p = .01$). These results provided support to reject the null hypothesis (see Table 15).

Table 15

Spearman-Rho Correlations Between Leadership Scale Items and Gender, Significant Correlations, Male Respondents (N = 151)

Item	Gender[a]	
74. Self-effacing = Presents self in a modest way	-0.26	****
86. Self-sacrificial = Forgoes self-interests and makes personal sacrifices in the interest of a goal or vision	-0.25	***
20. Just = Acts according to what is right or fair	-0.20	*

Note. [a]Gender: 1 = Male 2 = Female.
*$p < .05$. **$p < .01$. ***$p < .005$. ****$p < .001$.

Of the five largest correlations, two were associated with female respondents. Females gave higher ratings for Item 82, *Group-oriented = Concerned with the welfare of the group* ($r_s = .22$, $p = .008$) and Item 76, *Motive arouser = Mobilizes and activates followers* ($r_s = .19$, $p = .02$;). These results provided support to reject the null hypothesis (see Table 16).

Table 16

Spearman-Rho Correlations Between Leadership Scale Items and Gender, Significant Correlations, Female Respondents (N = 151)

Item	Gender[a]	
82. Group-oriented = Concerned with the welfare of the group	0.22	**
76. Motive arouser = Mobilizes and activates followers	0.19	*

Note. [a]Gender: 1 = Male and 2 = Female.
*$p < .05$. **$p < .01$. ***$p < .005$. ****$p < .001$.

Research question three. Research question three asked, *how are the views of the 112 leadership attributes related to age?* The alternative hypothesis stated, *at least one of the views of the 112 leadership attributes is related to age*, and the related null hypothesis stated, *none of the views of the 112 leadership attributes were related to age*.

To answer this question, Table 17 and Table 18 display the Spearman-Rho correlations between the 112 leadership attributes and age. When age was correlated with the 112 attributes, 16 were found to be significant and one was of moderate strength using the Cohen (1988) criteria: younger respondents gave higher ratings for Item 112, *Ritualistic = Uses a prescribed order to carry out procedures* (r_s = -.32, p = .000). After the one moderate correlation, of the next five largest correlations, four were associated with younger respondents. Younger respondents gave higher ratings for: (a) Item 57, Cautious = *Proceeds/performs with great care and does not take risks* (r_s = -.26, p = .002); (b) Item 4, *Bossy = Tells subordinates what to do in a commanding way* (r_s = -.23, p = .004); (c) Item 103, *Willful = Strong-willed, determined, resolute, persistent* (r_s = -.22, p = .007); and (d) Item 99, *Micro-manager = An extremely close supervisor, one who insists on making all decisions* (r_s = -.21, p = .009). These results provided support to reject the null hypothesis (see Table 17).

Table 17

Spearman-Rho Correlations Between Leadership Scale Items and Age, Significant Correlations, Younger Respondents (N = 151)

Item	Age	
112. Ritualistic = Uses a prescribed order to carry out procedures	-0.32	****
57. Cautious = Proceeds/performs with great care and does not take risks	-0.26	***
4. Bossy = Tells subordinates what to do in a commanding way	-0.23	***
103. Willful = Strong-willed, determined, resolute, persistent	-0.22	**
99. Micro-manager = An extremely close supervisor, one who insists on making all decisions	-0.21	**

Note. *$p < .05$. **$p < .01$. ***$p < .005$. ****$p < .001$.

After the one moderate correlation, of the next five largest correlations, one was associated with older respondents. Older respondents gave higher ratings for Item 68, *Normative = Behaves according to the norms of his or her group* ($r_s = .25$, $p = .002$). These results provided support to reject the null hypothesis (see Table 18).

Table 18

Spearman-Rho Correlations Between Leadership Scale Items and Age, Significant Correlations, Older Respondents (N = 151)

Item	Age	
68. Normative = Behaves according to the norms of his or her group	0.25	***

Note. *$p < .05$. **$p < .01$. ***$p < .005$. ****$p < .001$.

Research question four. Research question four asked, *how are the views of the 112 leadership attributes related to national origin group?* The alternative hypothesis stated, *at least one of the views of the 112 leadership attributes is related to national origin group*, and the related null hypothesis stated, *none of the views of the 112 leadership attributes are related to national origin group*.

Table 19 and Table 20 display the Spearman-Rho correlations between the 112 leadership attributes and national origin group variable. When national origin group was correlated with the 112 attributes, nine were found to be significant and none were of moderate strength using the Cohen (1988) criteria. Of the five largest correlations, four were associated with those

respondents from less Anglo-like national origin groups. Respondents from less Anglo-like national origin groups gave higher ratings for: (a) Item 26, *Calm = Not easily distressed* (r_s = -.23, p = .005); (b) Item 45, *Consultative = Consults with others before making plans or taking actions* (r_s = -.21, p = .01); (c) Item 14, *Risk taker = Willing to invest major resources in endeavors that do not have high probability of being successful* (r_s = -.21, p = .01); and (d) Item 4, *Bossy = Tells subordinates what to do in a commanding wa*y (r_s = -.21, p = .008). These results provided support to reject the null hypothesis (see Table 19).

Table 19

Spearman-Rho Correlations Between Leadership Scale Items and National Origin Group, Significant Correlations, Respondents from Less Anglo-like National Origin Groups (N = 151)

Item	National origin group[a]	
26. Calm = Not easily distressed	-0.23	**
45. Consultative = Consults with others before making plans or taking actions	-0.21	*
14. Risk taker = Willing to invest major resources in endeavors that do not have high probability of being successful	-0.21	*
4. Bossy = Tells subordinates what to do in a commanding way	-0.21	**

Note. [a]National Origin Group refers to one of nine country clusters ranked from least to most similar cultures to that of the Anglo country cluster, which includes Australia, Canada, England, Ireland, New Zealand, South Africa, and the United States. *p < .05. **p < .01. ***p < .005. ****p < .001.

Of the five largest correlations, one was associated with those respondents from more Anglo-like country clusters. Respondents from more Anglo-like clusters gave higher ratings for Item 52, *Subdued = Suppressed, quiet, tame* (r_s = .24, p = .003). These results provided support to reject the null hypothesis (see Table 20).

Table 20

Spearman-Rho Correlations Between Leadership Scale Items and National Origin Group, Significant Correlations, Respondents from More Anglo-like Country Clusters (N = 151)

Item	National origin group[a]	
52. Subdued = Suppressed, quiet, tame	0.24	***

Note. [a]*National Origin Group refers to one of nine country clusters ranked from least to most similar cultures to that of the Anglo country cluster, which includes Australia, Canada, England, Ireland, New Zealand, South Africa, and the United States.*p < .05. **p < .01. ***p < .005. ****p < .001.

Research question five. Research question five asked, *how are the views of the 112 leadership attributes related to the number of years worked in the United States?* The alternative hypothesis stated, *at least one of the views of the 112 leadership attributes is related to the number of years worked in the United States*, and the related null hypothesis stated, *none of the views of the 112 leadership attributes are related to the number of years worked in the United States*. To answer this question, Table 21 and Table 22 display the Spearman-Rho correlations between leadership attributes and years worked in U.S. When years worked in the U.S. was correlated with the 112 attributes, 14 were found to be significant and none were of moderate strength using the Cohen (1988) criteria. Of the five largest correlations, three were associated with those respondents having worked fewer years in the United States. Those respondents gave higher ratings for: (a) Item 4, *Bossy = Tells subordinates what to do in a commanding way* (r_s = -.28, p = .001); (b) Item 105, *Dishonest = Fraudulent, insincere* (r_s = -.24, p = .003); and (c) Item 57, *Cautious = Proceeds/performs with great care and does not take risks* (r_s = -.21, p = .009). These results provided support to reject the null hypothesis (see Table 21).

Table 21

Spearman-Rho Correlations Between Leadership Scale Items and Years Worked in the U.S., Significant Correlations, Respondents with Fewer Years Worked in the U.S. (N = 151)

Item	Years worked in U.S.	
4. Bossy = Tells subordinates what to do in a commanding way	-0.28	****
105. Dishonest = Fraudulent, insincere	-0.24	***
57. Cautious = Proceeds/performs with great care and does not take risks	-0.21	**

Note. *p < .05. **p < .01. ***p < .005. ****p < .001.

Of the five largest correlations, two were associated with those respondents having worked more years in the United States. Those respondents gave higher ratings for Item 68, *Normative = Behaves according to the norms of his or her group* (r_s = .24, p = .003) and Item 42, *Modest = Does not boast, presents self in a humble manner* (r_s = .21, p = .01). These results provided support to reject the null hypothesis (see Table 22).

Table 22

Spearman-Rho Correlations Between Leadership Scale Items and Years Worked in the U.S., Significant Correlations, Respondents with More Years Worked in the U.S. (N = 151)

Item	Years worked in U.S.	
68. Normative = Behaves according to the norms of his or her group	0.24	***
42. Modest = Does not boast, presents self in a humble manner	0.21	*

Note. *$p < .05$. **$p < .01$. ***$p < .005$. ****$p < .001$.

Research question six. Research question six asked, *how are the views of the 112 leadership attributes related to workforce category?* The alternative hypothesis stated, *at least one of the views of the 112 leadership attributes is related to workforce category*, and the related null hypothesis stated, *none of the views of the 112 leadership attributes are related to workforce category.* To answer this question, Table 23 and Table 24 display the Spearman-Rho correlations between the leadership attributes and years worked in U.S. When workforce category was correlated with the 112 attributes, 19 were found to be significant and none were of moderate strength using the Cohen (1988) criteria. Of the five largest correlations, two were associated with respondents having less organizational authority. Those respondents with less organizational authority gave higher ratings for Item 69, *Individually-oriented = Concerned with and places high value on preserving individual rather than group needs* (r_s = -.29, p = .001) and Item 7, *Autonomous = Acts independently, does not rely on others* (r_s = -.27, p = .001). These results provided support to reject the null hypothesis (see Table 23).

Of the five largest correlations, three were associated with respondents having more organizational authority. Those respondents with more organizational authority gave higher ratings for: (a) Item 102, *Visionary = Has a vision and imagination of the future* (r_s = .26, p = .002); (b) Item 15, *Sincere = Means what he/she says, earnest* (r_s = .23, p = .005); and (c) Item 42, *Modest = Does not boast, presents self in a humble man*ner (r_s = .21, p = .009). These results provided support to reject the null hypothesis (see Table 24).

Table 23

Spearman-Rho Correlations Between Leadership Scale Items and Workforce Category, Significant Correlations, Respondents with Less Organizational Authority (N = 151)

Item	Workforce category	
69. Individually-oriented = Concerned with and places high value on preserving individual rather than group needs	-0.29	****
7. Autonomous = Acts independently, does not rely on others	-0.27	****

Note. *$p < .05$. ** $p < .01$. *** $p < .005$. **** $p < .001$.

Table 24

Spearman-Rho Correlations Between Leadership Scale Items and Workforce Category, Significant Correlations, Respondents with More Organizational Authority (N = 151)

Item	Workforce category	
102. Visionary = Has a vision and imagination of the future	0.26	***
15. Sincere = Means what he/she says, earnest	0.23	***
42. Modest = Does not boast, presents self in a humble manner	0.21	**

Note. $p < .05$. ** $p < .01$. *** $p < .005$. **** $p < .001$.

Additional Findings

Table 25 displays the descriptive statistics for the 21 primary leadership style scales sorted by the highest mean rating. These ratings were based on a 7-point metric: 1 = *Inhibits Greatly* to 7 = *Contributes Greatly*. The highest rated scales were Integrity ($M = 6.55$) and Inspirational ($M = 6.43$). In contrast, the lowest rated scales were Malevolent ($M = 1.53$) and Self-Centered ($M = 1.96$).

Table 25

Descriptive Statistics of U.S. STEM Results for GLOBE's 21 Primary Leadership Scales Sorted by Highest Mean (N = 151)

Scale	*M*	*SD*
Integrity	6.55	0.56
Inspirational	6.43	0.53
Visionary	6.32	0.48
Performance-Oriented	6.31	0.67
Decisive	6.01	0.61
Team Integrator	5.85	0.48
Collaborative Team Orientation	5.73	0.56
Administratively Competent	5.73	0.71
Modest	5.67	0.75
Human-Oriented	5.62	0.89
Self-Sacrificial/Risk-Taker	5.55	0.74

(Continued)

Diplomatic	5.53	0.52
Bureaucratic	4.41	0.81
Autonomous	4.25	0.97
Status Conscious	3.92	1.33
Internally Competitive	3.41	0.85
Face-Saver	2.85	0.99
Nonparticipative	2.19	0.81
Autocratic	2.04	0.90
Self-Centered	1.96	0.72
Malevolent	1.53	0.53

Note. The scales were based on a 7-point metric: 1 = Inhibits Greatly to 7 = Contributes Greatly.

Table 26 displays a comparison of GLOBE's grand means scores, U.S. scores, and this study's U.S. STEM scores, provided for reference. Table 27 displays the Spearman correlations between the 21 primary leadership scales and the five demographic variables. For the resulting 55 correlations, ten correlations were significant but none were of moderate strength based on the Cohen (1988) criteria. The largest correlations indicated that younger respondents gave higher ratings for Bureaucratic (r_s = -.29, p = .001 (r_s = -.29, p = .001) and those with less organizational authority gave higher ratings for Face-Saver (r_s = -.20, p = .05).

Table 26

Comparison of the Mean Scores for 21 Primary Leadership Scales Sorted by GLOBE Highest Grand Mean

	Grand (n = ~17,300)		U.S. (n = 382)		U.S. STEM (n = 151)	
Primary Leadership Scale	*M*	*SD*	*M*	*SD*	*M*	*SD*
Integrity	6.07	.39	6.51	.55	6.55	.56
Inspirational	6.07	.36	6.35	.47	6.43	.53
Visionary	6.02	.36	6.28	.50	6.32	.48
Performance-Oriented	6.02	.37	6.46	.55	6.31	.67
Decisive	5.80	.44	5.96	.59	6.01	.61
Team Integrator	5.88	.40	6.03	.45	5.85	.48
Collaborative Team Orientation	5.46	.32	5.38	.60	5.73	.56
Administratively Competent	5.76	.39	5.63	.79	5.73	.71
Modest	4.98	.39	5.24	.76	5.67	.75
Humane	4.78	.49	5.19	.94	5.62	.89
Self-Sacrificial/Risk Taking	5.00	.41	5.16	.85	5.55	.74
Diplomatic	5.49	.30	5.46	.48	5.53	.52
Bureaucratic	3.87	.51	3.90	.76	4.41	.81
Autonomous	3.85	.44	3.75	1.01	4.25	.97
Status Conscious	4.34	.64	3.60	1.29	3.92	1.33
Internally Competitive	3.97	.48	3.53	.92	3.41	.85
Face-Saver	2.92	.56	2.66	.97	2.85	.99
Nonparticipative	2.66	.44	2.10	.69	2.19	.81

(Continued)

Autocratic	2.65	.46	2.03	.83	2.04	.90
Self-Centered	2.17	.35	1.97	.71	1.96	.72
Malevolent	1.80	.28	1.55	.45	1.53	.53

Note. The scales were based on a 7-point metric: 1 = Inhibits Greatly to 7 = Contributes Greatly.

Table 27

Descriptive Statistics of the 21 Primary Leadership Scales Sorted by Research Question (N = 151)

Scale	Gender	Age	National origin group	Years worked in U.S.	Workforce category
Autonomous	-0.01	0.06	-0.03	-0.05	-0.11
Visionary	-0.03	0.09	-0.03	0.15	0.08
Self-Sacrificial/Risk-Taker	-0.1	0.1	-0.16 *	0.03	0.12
Inspirational	0.16	0	-0.08	0.03	0.04
Decisive	-0.03	0.02	-0.13	-0.01	0.04
Integrity	-0.18 *	0.19 *	0	0.16	0.15
Performance-Oriented	0.02	0.04	0.03	0.12	0.17 *
Human-Oriented	0.07	0.03	-0.05	-0.01	0.04
Modest	-0.13	0.09	0.01	0.08	0.09
Autocratic	-0.05	0.15 *	-0.18 *	-0.19 *	-0.06
Nonparticipative	-0.11	0.06	0.02	-0.12	-0.15
Internally Competitive	-0.11	0.09	0.12	0.12	-0.1
Face-Saver	-0.08	0.04	0.06	-0.03	-0.2 *
Bureaucratic	-0.09	0.29 ****	-0.04	-0.15	-0.15
Self-Centered	-0.04	0.11	0.07	-0.07	-0.17 *
Status Conscious	0.01	0.12	-0.01	-0.08	-0.11
Administratively Competent	-0.06	0.06	-0.11	0	-0.04
Diplomatic	0.14	0.08	-0.06	0	-0.11
Malevolent	-0.02	0.12	0.05	-0.13	-0.15
Collaborative Team Orientation	-0.02	0.06	-0.08	-0.06	-0.01
Team Integrator	0.15	0.01	0.03	0.03	0.04

Note. The scales were based on a 7-point metric: 1 = Inhibits Greatly to 7 = Contributes Greatly.
*$p < .05$. ** $p < .01$. *** $p < .005$. **** $p < .001$.

Summary

A total of 151 people working in the U.S. STEM workforce within the business and industry sector, participated in this study, which sought to understand the degree to which certain leadership attributes were viewed as either inhibiting or contributing to outstanding leadership. This study also sought to identify what relationships existed, if any, between views of outstanding leadership and gender, age, national origin group, number of years worked in U.S., and workforce category. Research question one found that several of the leadership scale items

were viewed as contributing to outstanding leadership among U.S. STEM workers in business and industry (Table 14). Hypothesis two (leadership scale items related to gender) was supported (Tables 15 & 16). Hypothesis three (leadership scale items related to age) was supported (Tables 17 & 18). Hypothesis four (leadership scale items related to national origin group) was supported (Tables 19 & 20). Hypothesis five (leadership scale items related to number of years worked in the United States) was supported (Tables 21 & 22). Hypothesis six (leadership items related to workforce category) was supported (Tables 23 & 24). In Chapter Five, these findings will be compared to the literature, conclusions and implications will be drawn, and a series of recommendations will be presented.

Chapter Five: Discussion

This chapter will conclude the study of views of outstanding leadership among the U.S. STEM workforce within the business and industry sector. This study had two purposes, the first of which was to understand the degree to which 112 leadership attributes were viewed as either contributing to or inhibiting outstanding leadership among individuals working in U.S. STEM within the business and industry sector. The second purpose of this study was to identify which relationships existed, if any, between the views of outstanding leadership and gender, age, national origin group, number of years worked in U.S., and workforce category. To answer the research questions, this study applied the leadership scales from the GLOBE research survey form beta (GLOBE Foundation, 2006a). This final chapter presents an overview of the study, discussions of demographics and results, and implications and recommendations for future research.

Overview of the Study

STEM skills are crucial to America's global competitiveness, economic prosperity, and national security (National Science Board, 2018d; STEM Education Act of 2015, 2015; Trump, 2017). Organizations will face complex challenges finding and building U.S. STEM leaders who are able to adapt their leadership styles to meet the varying expectations of the U.S. STEM workforce. Societal cultures, organizational cultures, and personal histories produce unique individual conceptions and beliefs about leaders and leadership, and, as a result, individuals enter the workplace with different sets of expectations and ideals for leaders. In this sense, leadership is the process of being perceived as a leader (Foti, Hansbrough, Epitropaki, & Coyle, 2017; House et al., 2014; Lord, Day, Zaccaro, Avolio, & Eagly, 2017; Lord & Maher, 1991).

Implicit leadership theory. ILT proposes that unique personal histories, social interaction, individual experiences, and nonconscious information processing produce a set of notions about leadership that are individually unique. These notions or invisible expectations are referred to as ILTs or schemas (Eagly & Antonakis, 2015).

Leader emergence. A perceiver holds ILTs as an invisible belief system that places certain conditions on leaders. The perceiver observes behaviors or traits in an observed other and then concludes whether or not the observed other is a leader based on the fit with the perceiver's ILTs. Leaders emerge from the perceiver's cognitive or nonconscious information processing (Day, 2014; Lord & Maher, 1991). Relevant to the present study, an observed other is identified as a leader if he or she displayed behaviors and traits that the perceiver associated with leadership. An observed individual may be mismatched to one perceiver's ILTs, not be identified as a leader, and not win opportunities to lead (Lord et al., 1986). As first stated in the literature review, "a prerequisite for being a successful leader is to be perceived as a leader" (Moan & Hetland, 2012, p. 6).

Leader categorization. Leader categorization or leader effectiveness results when a leader's acts of leadership are judged as effective or ineffective, also based on a perceiver's ILTs. A perceiver observes outcomes, infers whether those outcomes resulted from the leader's acts, and additionally infers whether the leader's acts were effective or ineffective (Eagly & Antonakis, 2015). The perceiver again engages in nonconscious information processing. Either a match or gap results between the perceiver's ILTs and leadership acts of the leader. Relevant to the present study, the perceived outcomes of leadership, as well as the perceived effectiveness or ineffectiveness of different behaviors, are dependent on the perceiver's favorable or unfavorable views of the behaviors and traits exhibited by the leader (Day, 2014). The perceiver infers

whether observed organization outcomes are attributed to a leader's acts, whether or not those acts affected outcomes. It may go undetected that a leader's actions and organization outcomes are entirely unconnected. Further, perceivers may idealize specific behaviors and attributes, even though they may lack a direct connection to favorable organization results (Lord & Dinh, 2014). ILTs bias measurement of actual leadership performance and distract from true outcomes (Wilderom et al., 1999).

Individuals working in STEM in the U.S. within the business sector were surveyed regarding their views of outstanding leadership. Study participants were asked to consider the definition of an outstanding leader as "people in your organization or industry who are exceptionally skilled at motivating, influencing, or enabling you, others, or groups to contribute to the success of an organization or task" (GLOBE Foundation, 2006b, p. 10). Study participants then considered 112 leadership attributes and definitions and rated each attribute on a 7-point Likert scale ranging from greatly inhibits outstanding leadership to greatly contributes to outstanding leadership.

The five leader attributes rated as most contributing to outstanding leadership were: (a) trustworthy, (b) clear, (c) sincere, (d) inspirational, and (e) diplomatic. The five leader attributes rated as most inhibiting outstanding leadership were: (a) dishonest, (b) hostile, (c) vindictive, (d) tyrannical and (e) non-cooperative. There were 64 statistically significant correlations of low strength and one of moderate strength.

Discussion of Demographics

There were 151 surveys were completed for this study. Most of the study participants or 64.2% worked in computer, information sciences, or mathematical occupations. Approximately 19.9% percent of study participants reported working in engineering occupations. Approximately

15.9% of study participants worked in life, physical, or social sciences occupations. The distributions among occupation groups differed based on the data source, exact occupation grouping, and employment sector. Computing-related occupations consistently represent greater than 50% of the U.S. STEM occupation, followed by engineering and then the sciences (U.S. Department of Labor, Bureau of Labor Statistics, 2018a).

Males represented approximately three-quarters of the U.S. STEM population or 73.7% whereas females represented approximately one-quarter or 26.3% of the population. These distributions were representative of U.S. government statistics (U.S. Department of Labor, Bureau of Labor Statistics, 2017b). Study participants ranged in age between 52 and 71 years with a median age of 47 years. Approximately 72.8% of study participants originated from the United States. Consistent with statistics from the NSF (2017) that estimated 26.5% foreign-born population working in U.S. STEM the foreign-born population for this study was 27.2%.

Years worked in the United States ranged from less than 1 year to 51 years, with a median of 26.32 years, suggesting overall that the workforce is well acculturated. Regarding workforce category, most study participants or 53.6% worked in individual contributor roles. The remaining workforce category distributions were 9.9% first-level managers, 18.5% senior-level managers, and 17.9% executives or top-level managers.

Discussion of Results

GLOBE established two criteria for an attribute to be considered universally endorsed as contributing to outstanding leadership. First, the individual attribute required a mean score exceeding 5.0 for 95% of societal averages. Second, the individual attributes required a worldwide mean exceeding 6.0 when the scores of 62 societies were considered together. Applying these criteria, GLOBE identified 22 of the 112 leadership attributes measured as

universally endorsed across 62 societies as contributing to outstanding leadership. In this study, each of these 22 attributes exceeded a mean score greater than 5.0. Further, GLOBE identified 36 of the 112 leadership attributes measured as culturally contingent. Whether these attributes were viewed as contributing to or inhibiting outstanding leadership varied based on the society. A comparison of this study's results and GLOBE's results for universally endorsed and culturally contingent attributes is presented in Table T1 (see APPENDIX W).

Research question one. Which of the 112 leadership attributes are viewed as contributing to outstanding leadership among U.S. STEM workers in business and industry? In the present study, the five leader attributes with the highest ratings viewed as most contributing to outstanding leadership were: (a) trustworthy, (b) clear, (c) sincere, (d) inspirational, and (e) diplomatic. These five attributes rated as most contributing to outstanding leadership among U.S. STEM workers in the business and industry sector are listed subsequently in order of average means score, high to low. Each attribute is accompanied by its definition and corresponding findings, or lack of findings, in the literature review.

***Trustworthy*.** Trustworthy, defined as *deserves trust, can be believed and relied upon to keep his/her word*, was the highest rated attribute ($M = 6.81$), among the 112 rated attributes. The attribute was also the highest rated attribute in GLOBE with world mean score of 6.36. GLOBE found that the attribute trustworthy was universally endorsed as contributing to outstanding leadership (House et al., 2014).

***Clear*.** Clear, defined as *easily understood*, was the second highest rated attribute ($M = 6.65$), among the 112 rated attributes. In GLOBE, the attribute clear was neither universally endorsed nor culturally contingent. Findings for the clear leader attribute are consistent with other findings in GLOBE. For example, GLOBE revealed that the U.S. is a highly performance-

oriented society, typically preferring direct and explicit communication. GLOBE referred to performance-oriented cultures as low-context (Javidan, 2004). Low context language is clear and explicit, and typical of more assertive societies such as the U.S., in contrast to cultures that are high context and adopt more subtle styles of communication and implied messages.

Sincere. Sincere, defined as *means what he/she says, earnest*, was the third highest rated attribute contributing to outstanding leadership ($M = 6.62$), among the 112 rated attributes. GLOBE found sincerity was a culturally contingent leader attribute. Views of whether this attribute either inhibited or contributed to outstanding leadership varied depending on the societal culture (House et al., 2014).

Inspirational. Inspirational, defined as *inspires emotions, beliefs, values, and behaviors in others*, was the fourth highest rated attribute contributing to outstanding leadership ($M = 6.60$), among the 112 rated attributes. In GLOBE, the attribute of inspirational was neither universally endorsed nor culturally contingent (House et al., 2014).

Diplomatic. Diplomatic, defined as *skilled at interpersonal relations, tactful*, was the fifth highest rated attribute contributing to outstanding leadership ($M = 6.60$), among the 112 rated attributes. In GLOBE, the attribute of diplomatic was neither universally endorsed nor culturally contingent (House et al., 2014).

Research question two. How are the views of the 112 leadership attributes related to gender? Gender was correlated with the 112 leader attributes, producing seven statistically significant findings. The five attributes receiving the highest correlations are discussed subsequently. Each attribute is accompanied by its definition and corresponding findings, or lack of findings, in the literature review.

Male respondents. Of the five largest correlations, three attributes rated as contributing to outstanding leadership were associated with male respondents. These attributes were: (a) self-effacing, (b) self-sacrificial, and (c) just. Although overall these attributes were each viewed as contributing to outstanding leadership, male respondents favored these attributes more so than female respondents.

Self-effacing. Self-effacing (M = 5.03, r_s = -.26, p = .001) was defined as, *presents self in a modest way*. Self-effacing received higher favorable scores among male respondents. GLOBE found the attribute self-effacing was a culturally contingent leader attribute. Views of whether this attribute either inhibited or contributed to outstanding leadership varied depending on the societal culture (House et al., 2014).

Self-sacrificial. Self-sacrificial (M = 5.34, r_s = -.25, p = .002) was defined as, *forgoes self-interests and makes personal sacrifices in the interest of a goal or vision*. Self-sacrificial received higher, favorable scores among male respondents. GLOBE found that the attribute self-sacrificial was a culturally contingent leader attribute. Views of whether this attribute either inhibited or contributed to outstanding leadership varied depending on the societal culture (House et al., 2014).

Just. Just (M = 6.24, r_s = -.20, p = .01) was defined as, *acts according to what is right or fair*. The attribute just received higher, favorable scores among male respondents. GLOBE found that the attribute was universally endorsed as contributing to outstanding leadership (House et al., 2014).

Female respondents. Of the five largest correlations, three attributes rated as contributing to outstanding leadership were associated with female respondents. These attributes were: (a) group-oriented and (b) motive-arouser. While overall each of these attributes was viewed as

contributing to outstanding leadership, female respondents favored these attributes more so than male respondents.

Group-oriented. Group-oriented ($M = 6.11$, $r_s = .22$, $p = .008$) was defined as *concerned with the welfare of the group*. The attribute group-oriented evidenced higher favorable scores among female respondents. In GLOBE, the attribute group-oriented was neither universally endorsed nor culturally contingent (House et al., 2014). Referring to the literature review, Diekman et al. (2015) examined the minority presence of women in STEM occupations and found that women are generally oriented towards others. They found that women in STEM occupations seek community building, inclusiveness, and cooperation in the work environment. The authors provided the example of a scientist who works alone or in a team, yet his or her goal is to advance the reputation of the group or individuals in the group. Women are deterred from certain STEM occupations because they believe those occupations or environments will not support communal goals.

Motive-arouser. Motive-arouser ($M = 6.58$, $r_s = .19$, $p = .02$) was defined as *mobilizes and activates followers*. The attribute motive-arouser evidenced higher favorable scores among females. GLOBE found that the attribute motive-arouser was universally endorsed as contributing to outstanding leadership (House et al., 2014).

Findings in the literature review suggested that women in STEM are sometimes subject to social identity threat or being devalued when its believed that women's input is not as valued as men's input (Diekman et al., 2015). Although it might be expected women would favor egalitarian or mentoring leadership behaviors, there were no prominent findings in this area in this study.

Research question three. How are the views of the 112 leadership attributes related to age? Age was correlated with the 112 leader attributes, producing 16 statistically significant findings. One attribute of moderate strength and the next five attributes receiving the highest correlations are discussed subsequently. Each attribute is accompanied by its definition and corresponding findings, or lack of findings, in the literature review.

Younger respondents. The one attribute of moderate strength associated with younger respondents was *ritualistic*. Of the next five largest correlations, four were associated with younger respondents. These attributes were: (a) cautious, (b) bossy, (c) willful, and (d) micro-manager. The attributes of cautious, bossy, and micro-manager were viewed as inhibiting outstanding leadership, whereas willful was viewed as contributing to outstanding leadership. Younger respondents were more accepting of these attributes than older respondents.

Ritualistic. Beginning with the one statistically significant finding of moderate strength, ritualistic ($M = 3.65$, $r_s = -.317$, $p = .000$) was defined as *uses a prescribed order to carry out procedures*. The attribute ritualistic evidenced higher scores among younger respondents. In GLOBE, the attribute ritualistic was neither universally endorsed nor culturally contingent (House et al., 2014).

Cautious. Continuing with the next highest statistically significant findings of low strength, *cautious* ($M = 3.46$, $r_s = -.26$, $p = .002$) was defined as *proceeds/performs with great care and does not take risks*. The attribute cautious evidenced higher moderate scores among younger respondents. GLOBE found the attribute cautious was a culturally contingent leader attribute. Views of whether this attribute either inhibited or contributed to outstanding leadership varied depending on the societal culture (House et al., 2014).

Bossy. Bossy (M = 2.38, r_s = -.231, p = .004) was defined as *tells subordinates what to do in a commanding way*. The attribute bossy evidenced higher, yet unfavorable scores among younger respondents. In GLOBE, the attribute bossy was neither universally endorsed nor culturally contingent (House et al., 2014).

Willful. Willful (M = 5.73, r_s = -.22, p = .007) was defined as *strong-willed, determined, resolute, persistent.* The attribute willful evidenced higher, favorable scores among younger respondents. GLOBE found the attribute willful was a culturally contingent leader attribute. Views of whether this attribute either inhibited or contributed to outstanding leadership varied depending on the societal culture (House et al., 2014).

Micro-manager. Micro-manager (M = 1.66, r_s = -.21, p = .009) was defined as *an extremely close supervisor, one who insists on making all decisions*. The attribute micro-manager evidenced higher, yet unfavorable scores among younger respondents. GLOBE found the attribute willful was a culturally contingent leader attribute. Views of whether this attribute either inhibited or contributed to outstanding leadership varied depending on the societal culture (House et al., 2014).

Reflecting on the findings, it could be inferred that younger respondents are potentially more tolerant of leaders who establish controlled work environments whereas older respondents are less tolerant. Findings in the literature review suggested that younger generations entering U.S STEM workforce may favor those leadership approaches that further teaming, provide support or solicit input, but these findings were not prominent in the results of this study. One possible reason is that individuals simply vary in their orientations toward supervisors in the workplace, and these orientations are possibly driven more so by individuality than generations.

Older respondents. After the one finding of moderate strength, of the five largest correlations, one attribute rated as only slightly contributing to outstanding leadership was associated with older respondents. This attribute was *normative*. Older respondents favored this attribute more so than younger respondents.

Normative. Normative ($M = 4.56$, $r_s = .25$, $p = .002$) was defined as *behaves according to the norms of his or her group*. The attribute normative evidenced higher, favorable scores among older respondents. In GLOBE, the attribute normative was neither universally endorsed nor culturally contingent (House et al., 2014). Reflecting on this finding, it might be inferred that older respondents see effective leaders as fitting in or conforming to a team's norms. Referring to the literature review, it was anticipated that older respondents would place greater value on administrative and technical attributes, but these findings were not prominent.

Research question four. How are the views of the 112 leadership attributes related to national origin group? National origin group was correlated with the 112 leader attributes, producing nine statistically significant findings. The five attributes receiving the highest correlations are discussed subsequently. Each attribute is accompanied by its definition and corresponding findings, or lack of findings, in the literature review.

***Less Anglo-like countries*.** Of the five largest correlations, four attributes were associated with less Anglo-like countries. These attributes were: (a) calm, (b) consultative, (c) risk taker, and (d) bossy. Less Anglo-like countries either favored or tolerated these attributes more so than more Anglo-like countries.

Calm. Calm ($M = 6.21$, $r_s = -.23$, $p = .005$) was defined as *not easily distressed*. This attribute experienced higher favorable scores among less Anglo-like countries. In GLOBE, the attribute of calm was neither universally endorsed nor culturally contingent (House et al., 2014).

Consultative. Consultative (M = 6.09, r_s = -.21, p = .01) was defined as, *consults with others before making plans or taking actions*. This attribute experienced higher favorable scores among less Anglo-like countries. In GLOBE, the attribute consultative was neither universally endorsed nor culturally contingent (House et al., 2014).

Risk taker. *Risk taker* (M = 5.26, r_s = -.21, p = .01) was defined as *willing to invest major resources in endeavors that do not have high probability of being successful*. This attribute experienced higher, favorable scores among less Anglo-like countries. GLOBE found the attribute Risk taker was a culturally contingent leader attribute. Views of whether this attribute either inhibited or contributed to outstanding leadership varied depending on the societal culture (House et al., 2014). Referring to the literature, the NSF (2018) found that the U.S. ranked 11th in R&D intensity. No countries holding the top 10 positions fall within the Anglo National Origin Group. Israel holds the top spot and falls within the Latin Europe National Origin Group. In fact, three of the National Origin Groups dominate the remaining nine positions for highest R&D intensity. Nordic Europe occupies three positions (Denmark, Finland, and Sweden). Germanic Europe occupies three positions (Austria, Germany, and Switzerland). Confucian Asia, one of the least Anglo-like National Origin Groups, occupies three positions (Japan, South Korea, and Taiwan). China, an aggressive U.S. competitor, also falls within Confucian Asia. The findings of this study seem to support the NSF's findings regarding nations aggressively pursuing innovation.

Bossy. Bossy, defined as, *tells subordinates what to do in a commanding way* (M = 2.38, r_s = -.21, p = .008). Less Anglo-like countries tolerated bossiness more so than more Anglo-like countries. As highlighted earlier, the attribute bossy was neither universally endorsed nor culturally contingent in GLOBE (House et al., 2014). Reflecting on the findings for younger

respondents who were also more tolerant of leaders who exhibited the leadership trait of being bossy, it could be inferred that with greater familiarity with the U.S. workplace, workers are less tolerant of this attribute.

***More Anglo-like countries*.** Of the five largest correlations, one attribute, Subdued, was associated with more Anglo-like countries. While this attribute was viewed as inhibiting outstanding leadership, respondents from more Anglo-like clusters were more tolerant.

Subdued. Subdued ($M = 3.0$, $r_s = .24$, $p = .003$) was defined as *suppressed, quiet, tame*. The attribute subdued evidenced higher, yet unfavorable scores among more Anglo-like respondents. GLOBE found the attribute subdued was a culturally contingent leader attribute. Views of whether this attribute either inhibited or contributed to outstanding leadership varied depending on the societal culture. In fact, this attribute was the second most polarizing attribute in GLOBE, the first most being the attribute cunning (House et al., 2014).

Research question five. How are the views of the 112 leadership attributes related to the number of years worked in the United States? Years worked in the United States was correlated with the 112 leader attributes, producing 14 statistically significant findings. The five attributes receiving the highest correlations are discussed subsequently. Each attribute is accompanied by its definition and corresponding findings, or lack of findings, in the literature review.

***Fewer years worked in the U.S.*.** Of the five largest correlations, three were associated with respondents having worked fewer years in the U.S. These attributes were: (a) bossy, (b) dishonest, and (c) cautious. Whereas overall these attributes were each viewed as inhibiting outstanding leadership, respondents having worked fewer years in the U.S. were more tolerant than those respondents having worked more years in the U.S.

Bossy. Bossy ($M = 2.38$, $r_s = -.28$, $p = .001$) was defined as *tells subordinates what to do in a commanding way*. The attribute of bossy evidenced higher, yet unfavorable scores among respondents having worked fewer years in the U.S. As stated previously, the attribute bossy was neither universally endorsed nor culturally contingent in GLOBE (House et al., 2014). Reflecting on the findings for younger respondents and those individuals from less Anglo-like countries, one can perhaps infer with these findings that individuals less familiar with or established in the U.S. STEM workplace may be more tolerant of bossy leaders than individuals more familiar with or established in the U.S. STEM workplace

Dishonest. Dishonest ($M = 1.15$, $r_s = -.24$, $p = .003$) was defined as *fraudulent, insincere*. The attribute of dishonest evidenced higher, yet unfavorable scores among respondents having worked fewer years in the U.S. Referring to Research Question One, the attribute dishonest received the lowest median score and was viewed in this study as the attribute most inhibiting outstanding leadership. As described earlier, the attribute dishonest was neither universally endorsed nor culturally contingent (House et al., 2014).

Cautious. Cautious ($M = 3.22$, $r_s = -.21$, $p = .009$) was defined as *proceeds/performs with great care and does not take risks*. The attribute cautious evidenced higher, yet unfavorable scores among respondents who had worked fewer years in the U.S. Referring to younger respondents, the attribute Cautious was more tolerated by these respondents. From these findings, it might be inferred that individuals less established in the U.S. STEM workplace, such as younger workers and those workers with fewer years working in the U.S. are more accepting of a cautious leadership style, although caution is generally viewed as inhibiting outstanding leadership.

Reflecting on individuals with fewer years worked in the U.S., these results somewhat complement findings in the literature review. The literature review anticipated that STEM workers originating from other countries might adopt coping mechanisms to adapt to the U.S. STEM workplace, depending on time spent in the U.S. (Ward, 2008). It might also be inferred that these coping and adapting mechanisms are first steps toward furthering a global mindset (Bird & Mendenhall, 2016; Gonzalez-Loureiro et al., 2015).

More years worked in the U.S. Of the five largest correlations, two were associated with those respondents who had worked more years in the United States. These attributes were *normative* and *modest*. While overall these attributes were each viewed as more or less contributing to outstanding leadership, respondents who had worked more years in the U.S. favored these attributes more so than those respondents who had worked fewer years in the U.S.

Normative. Normative ($M = 4.56$, $r_s = .24$, $p = .003$) was defined as *behaves according to the norms of his or her group*. The attribute of normative evidenced higher, yet unfavorable scores among respondents having worked more years in the United States. In GLOBE, the attribute normative was neither universally endorsed nor culturally contingent (House et al., 2014). Referring to age, this finding for respondents having worked more years in the U.S. is consistent with the finding that older respondents. From these findings, it might be inferred that older respondents or those respondents who have worked longer in the U.S. STEM environment evidence greater favor for a normative leadership style. Referring to the literature, these findings are consistent with the notion of acculturation. The literature review anticipated findings for homogenization or marginalization of cultures over time (Gonzalez-Loureiro et al., 2015).

Modest. Modest ($M = 5.5$, $r_s = .21$, $p = .01$) was defined as *does not boast, presents self in a humble manner*. The attribute modest evidenced higher favorable scores among respondents

having worked more years in the United States. As stated earlier, the attribute modest was neither universally endorsed nor culturally contingent in GLOBE (House et al., 2014). Referring to male respondents, it might be inferred that individuals who have worked more years in the U.S., particularly of the male gender, may prefer a modest leadership style.

Research question six. How are the views of the 112 leadership attributes related to workforce category? Workforce category was correlated with the 112 attributes, producing 19 statistically significant findings. The five attributes receiving the highest correlations are discussed subsequently. Each attribute is accompanied by its definition and corresponding findings, or lack of findings, in the literature review.

Less organizational authority. Of the five largest correlations, two attributes were associated with respondents possessing less organizational authority. These attributes were *individually-oriented* and *autonomous*. While overall these attributes were viewed as somewhat inhibiting outstanding leadership, those respondents with less organization authority evidenced more tolerance for these attributes than those respondents with more organization authority.

Individually-oriented. Individually-oriented ($M = 3.15$, $r_s = -.29$, $p = .001$) was defined as *concerned with and places high value on preserving individual rather than group needs*. The attribute individually-oriented evidenced higher, yet somewhat unfavorable scores among those respondents with less organizational authority. In GLOBE, the attribute individually-oriented was neither universally endorsed nor culturally contingent (House et al., 2014).

Autonomous. Autonomous ($M = 3.85$, $r_s = -.27$, $p = .001$) was defined as *acts independently, does not rely on others.* The attribute autonomous evidenced higher, yet somewhat unfavorable scores among those respondents with less organizational authority. GLOBE found the attribute autonomous was a culturally contingent leader attribute. Views of

whether this attribute either inhibited or contributed to outstanding leadership varied depending on the societal culture (House et al., 2014).

More organizational authority. Of the five largest correlations, three attributes were associated with respondents having more organizational authority. These attributes were: (a) visionary, (b) sincere, and (c) modest. While overall these attributes were viewed as contributing to outstanding leadership, respondents with more organization authority evidenced higher favorable ratings for these attributes and those respondents with less organization authority.

Visionary. Visionary ($M = 6.44$, $r_s = .26$, $p = .002$) was defined as *has a vision and imagination of the future*. The attribute visionary evidenced higher favorable ratings among those respondents with more organizational authority. In GLOBE, the attribute visionary was neither universally endorsed nor culturally contingent (House et al., 2014).

Sincere. Sincere ($M = 6.62$, $r_s = .23$, $p = .005$) was defined as *means what he/she says, earnest*. The attribute sincere evidenced higher favorable ratings among those respondents with more organizational authority. As stated earlier, GLOBE found the attribute sincere was a culturally contingent leader attribute. Views of whether this attribute either inhibited or contributed to outstanding leadership varied depending on the societal culture (House et al., 2014). As highlighted earlier, the attribute sincere was the third highest rated attribute in this study, viewed as contributing to outstanding leadership.

Modest. Modest ($M = 5.50$, $r_s = .21$, $p = .009$) was defined as *does not boast, presents self in a humble manner*. The attribute modest evidenced higher favorable scores among those respondents with more organizational authority. As highlighted previously, the attribute modest was neither universally endorsed nor culturally contingent in GLOBE (House et al., 2014).

Similar to individuals with more organizational authority, individuals with more years working in the U.S. favored modesty as a leader attribute. It might be inferred that given tenure and managerial achievement, individuals may value a modest leadership style in the U.S. STEM workplace.

Looking back on these findings for organizational authority, the literature review anticipated that respondents with less organizational authority might favor social or adaptive leadership behaviors for dealing with teams. The literature review further anticipated that respondents with more organizational authority might favor technical and administrative attributes. Neither finding in the literature review was prominent in this study's findings.

Other findings. Consistent with the GLOBE's findings for the Anglo cluster, most of the attributes endorsed as contributing outstanding leadership corresponded to charismatic/value-based, team-oriented, and participative global leadership styles. GLOBE's 21 primary leadership scales were correlated with the five demographic variables in this study, producing 10 statistically significant findings. For the highest correlations, younger respondents gave higher ratings for Bureaucratic. Those respondents with less organizational authority gave higher ratings for Face-saver.

In this study, a total of 61 attributes of the 112 achieved mean scores greater than 5.0, evidencing that these attributes were viewed as contributing to outstanding leadership. In this study, GLOBE's 22 positively endorsed leader attributes, viewed as contributing to outstanding leadership, achieved a mean score greater than 5.0 (see APPENDIX W).

The five leader attributes viewed as most inhibiting outstanding leadership were: (a) dishonest, (b) hostile, (c) vindictive, (d) tyrannical, and (e) non-cooperative.

Discussion of Strengths and Weaknesses

Certain strengths and weaknesses of this study should be discussed. First, the GLOBE leadership scales were successful in accomplishing the goals of this study. In phase one of GLOBE, the scales items were translated, back-translated, and successfully applied across 62 societies, maximizing the likelihood that the attributes would be consistently interpreted by survey respondents. Although the results of this study are not generalizable to other populations, the study achieved population distributions representative of U.S. STEM. Although this study contributes preliminary findings to assist in furthering leadership capability across U.S. STEM, the study is not without limitations. Culture studies are complex and the usefulness of country clusters is greatly debated. The researcher did not attempt to replicate GLOBE or undertake a cultural study, which alternatively requires extensive resources and time to account for innumerable complex variables. Accordingly, Research Question Five, which attempted to correlate views of outstanding leadership to national origin group, is not particularly strong methodologically.

Conclusions

This section highlights conclusions resulting from this study of views of outstanding leadership among the U.S. STEM workforce within the business and industry sector.

The U.S. STEM workforce values leaders who are trustworthy. The attribute of trustworthy was the top scoring attribute, universally endorsed as contributing to outstanding leadership, both in GLOBE and this study of U.S. STEM. A leader's degree of trustworthiness affects organizations at a fundamental level. Leaders set the tone in the work environment, including the level of trust. Trust is a psychological state. Followers evaluate the intentions and expectations of others, including leaders, and then decide whether it is safe to be vulnerable.

Trust becomes a factor in deciding whether to cooperate with others, including leaders (Klaussner, 2012). Trust in leaders also translates to higher job satisfaction (Gilstrap & Collins, 2012).

The U.S. STEM workforce values leaders who communicate clearly. Leadership communication can be interpreted exactly as the leader intended or entirely different than the leader intended (Ruben & Gigliotti, 2016). The evolving body of cross-cultural literature evidences diverse and even opposing views of both leadership and leader communication. These views vary by gender, age, nationality, the degree of assimilation, and profession (Hofstede et al., 2010). Given these ILTs, the potential exists that any leader's communication might be judged as unclear, potentially diminishing the leader's social influence and follower action. Although not central to this study, it is worth noting that in a world of over-messaging, leaders compete for the followers' mindshare, which presents an additional risk that a leader will be misunderstood or not heard. Therefore, it is important that leaders message clearly.

The U.S. STEM workforce values leaders who are sincere. Sincerity suggests an honesty of mind or freedom from hypocrisy ("Sincerity," n.d.). Realistically, leaders cannot be transparent in all matters, with all people, all the time. For example, leaders may act with necessary reservation and discretion for reasons of behavioral integrity towards the organization, which may simultaneously draw scrutiny. Apart from these contextual limitations, sincere leaders are congruent in action and deed (Avolio, 2016).

The U.S. STEM workforce values leaders who are inspirational. An inspirational leadership approach can help break through personal agendas and interpersonal barriers to move the organization forward (Bass, 1985). Inspirational leaders envision possibilities, draw on shared aspirations, and get people to work together (Kouzes & Posner, 2011). Inspirational

leaders articulate a picture of the future in ways that are compelling. These leaders convey meaning in work (Bass & Riggio, 2006).

Although not central to this study, it is worth noting that inspirational leadership has been explored neurologically. Neurological responses to inspirational leadership rhetoric were explored through the observation of functional magnetic resonance imaging (fMRI). Preliminary findings suggested that the human brain responds uniquely to inspirational messages spoken by leaders with whom there is a group affiliation. The results seemed to support a response to inspirational leadership and that collective-oriented messages achieve greater engagement. Leaders who inspired others seemed to evidence a shared social identity with potential followers (LRN, 2016).

The U.S. STEM workforce values leaders who are diplomatic. Like diplomacy across the world, diplomacy in organization signals societal conditions, notions of an open world, and the importance of openness as a condition for progress. However, diplomacy and tact can facilitate either diplomacy or secrecy, depending on the views or intentions of the individual or society (Cottey, 2016). At a basic level, the mark of leader diplomacy is extending goodwill and not demoralizing others in the process of accomplishing objectives. Diplomacy requires personal self-regulation that results in consideration of and sensitivity towards other's feelings. When leaders succumb to non-diplomatic behaviors, individuals feel invalidated and discounted and engagement in organization objectives diminishes (Kamin, 2013).

Implications and Recommendations

This section highlights implications and recommendations for business leaders, HR practitioners, and educators who prepare leaders for the increasingly cross-cultural U.S. STEM workplace.

Build trustworthy leaders. Becoming a trustworthy leader is a complex process. Referring to the literature review and ILTs, the follower will judge the acts of leadership as effective or ineffective, subject to that follower's schema of what constitutes trustworthiness (Lord & Maher, 1991). Trust is an interactive process between a leader and a follower that occurs over time. Trust in a leader evolves based the on the past, present, and anticipated future interactions between the follower and leader. Therefore, a leader's behavioral consistency is critical (Klaussner, 2012).

Build leaders who can communicate clearly. Given ILTs, developing leaders who embody the attribute Clear requires a broad and systemic approach to developing communication capabilities. Communication is both a strategic and transactional mechanism, as well as a mechanism for both intended outcomes and a broader system of social influence. Whereas leadership is occurring on different levels, individual or group, communication is also occurring on different levels. The implications for developing leaders depends on which of these dimensions leadership and communication are conceptualized (Ruben & Gigliotti, 2016).

Organizations must simultaneously shape the expectations and attributes of leaders and followers. From a strategic perspective, organizations should help leaders and followers acquire a global mindset or intercultural competence. A global mindset and intercultural competence enable individuals to engage in cultural frame-switching to communicate and influence a diverse workforce (Gonzalez-Loureiro et al., 2015). On a tactical level, leaders can acquire skills to improve the structure, content, and delivery of leadership communication to be clearer. Development should include both verbal and non-verbal aspects of communication as mechanisms of leadership (Ruben & Gigliotti, 2016).

Build leaders who are sincere. There are practical ways that organizations can strengthen a leader's ability to be sincere. Leaders cannot be fully sincere and transparent in some matters requiring organization discretion. Still, organizations can help leaders understand sincerity in the context of strategic organization communications that require discretion and sincerity in the context of relationships with team members. Leaders can evidence sincerity by acting on suggestions and criticisms. Leaders should work to minimize the appearance of insincerity or pretense by making commitments that are well resourced and well planned. Additionally, leaders must receive training in how to present claims that are well researched and supported by facts. Further, organizations should develop team members who are able to evaluate context, along with all facts and data on leadership actions, before judging a leader's actions as non-transparent (Avolio, 2016). Ultimately, leaders must foster a climate of psychological safety where thoughtful transparency and candor are embraced as normal behaviors.

Build leaders who can inspire. Although the ability to inspire is often thought of as an innate trait or mark of extroversion, there are practical ways organizations can strengthen a leader's ability to inspire. At a tactical level, leaders should be trained to promote the organization's values through stories. Organizations can build accountability and transparency in leaders. Leaders should honor commitments, seek feedback, and share responsibility for the organization's outcomes, good or bad. Leaders can be developed to encourage others to express their views and create a safe environment to take risks. Organizations should support leaders by establishing structure and resources to support impactful decisions. At a strategic level, leaders can be helped to pursue greater significance in the workplace. Organizations can engage executive role models in leadership development programs or leverage executives as mentors to

help junior leaders become more deeply affected by the mission of the organization (LRN, 2016).

Build leaders who are diplomatic. Organizations can develop leaders who are more diplomatic. Diplomacy in leaders means extending good will and not demoralizing others in the process of getting one's objectives met. Diplomacy is a decision to self-regulate and apply tact as consideration and sensitivity towards other's feelings. Organizations can educate leaders in the more subtle and contagious forms of invalidating others (Kamin, 2013).

The foundation of diplomacy is becoming a good listener. Becoming a good listener necessitates self-regulation such as setting aside ego, focusing energy on others, and listening holistically without opinion and judgment. These behaviors establish an environment of acceptance and safety, conducive to mutual sharing of insights and concerns. At a tactical level, organizations can help leaders develop their listening and interactive skills (Kamin, 2013).

Directions for Future Research

Three recommendations for future research are proposed. One recommendation for future research is conducting the research on a larger, more sophisticated scale, perhaps extending GLOBE to U.S. STEM through the GLOBE network or obtaining sponsorship and partnership through the NSF. The second recommendation for future research is developing a training program focusing on the attributes identified in the recommendations and then measuring the outcomes. The third recommendation for smaller studies is narrowing this study in U.S. STEM using a more tightly controlled set of variables.

Summary

The chapter concludes this study on views of outstanding leadership among the U.S. STEM workforce within the business and industry sector. STEM skills and associated R&D are

critical to maintaining the nation's global competitiveness, economic prosperity, and national security (National Science Board, 2018d; Noonan, 2017; STEM Education Act of 2015, 2015; Trump, 2017). U.S. Jobs within STEM occupations will grow approximately 11.1% between 2016 and 2026 (U.S. Department of Labor, Bureau of Labor Statistics, 2017a). In addition to this growth, it is anticipated more women, generations, and foreign-born workers will enter U.S. STEM occupations (STEM Education Act of 2015, 2015; U.S. Congress, 2017; U.S. Department of Homeland Security, 2016; White House Office of Science and Technology Policy, 2016). U.S. STEM leaders will encounter an increasingly cross-cultural workforce. ILTs place certain conditions on leaders and leadership. To be identified as a leader, viewed as an effective leader, and be given opportunities to lead in U.S. STEM, an individual must exhibit attributes and characteristics that conform to individual paradigms of the U.S. STEM workforce (Foti et al., 2017; House et al., 2014; Lord et al., 2017; Lord & Maher, 1991).

In support of U.S. maximized global competitiveness, and anticipating U.S. STEM job growth and shifts in U.S. STEM demographics, this study explored the views outstanding leadership among the U.S. STEM workforce in business and industry. To do this, this correlational study applied the GLOBE leadership scales, exploring views according to age, gender, national origin group, years worked in the U.S., and workforce category. The five leader attributes rated as most contributing to outstanding leadership were: (a) trustworthy, (b) clear, (c) sincere, (d) inspirational, and (e) diplomatic. There were 64 statistically significant findings of low strength and only one of moderate strength, seeming to support the existence of ILTs.

Individuals enter the workplace with different sets of expectations and ideals for leaders, resulting from their societies, organizations, and personal histories (Foti et al., 2017; House et al., 2014; Lord et al., 2017; Lord & Maher, 1991). The U.S. must increase its emphasis on ensuring a

robust supply of capable STEM leaders who are able to successfully adapt their leadership styles to meet the varying expectations of the U.S. STEM workforce.

Final Thoughts

The researcher strove to undertake a study that would produce useful recommendations for business leaders, HR practitioners, and educators who are responsible for preparing leaders for the increasingly cross-cultural U.S. STEM workplace. This study explored the history and evolution of U.S. STEM. The problem of U.S. STEM leadership within the business and industry sector was contextualized and defined. Research questions were designed to address key challenges and assumptions that emerged. STEM data was updated as new data became available from the DoL and the NSF. Emergent research and political developments were monitored. A research tool was selected that was believed to best support the needs of an international audience. Great efforts were made to reach a representative sample. Care was taken to expose weaknesses of the study's design. At many levels, nail-biting shifts in the political environment over the past 2 years slowed and sometimes threatened completion of the study. Finally, a detailed analysis was performed, findings were presented, and the intended set of recommendations was offered for consideration.

REFERENCES

45 Moments in NASA History. (n.d.). Retrieved from http://www.nasa.gov/externalflash/NASA45/textonly/history.html

Agbor, E. (2008). Creativity and innovation: The leadership dynamics. *Journal of Strategic Leadership, 1*(1), 39-45. Retrieved from https://www.regent.edu/acad/global/publications/jsl/home.htm

Alimo-Metcalfe, B., & Alban-Metcalfe, J. (2012). The need to get more for less: a new model of engaging leadership and evidence of its effect on team productivity, and staff morale and wellbeing at work. In P. Hutchings & P. Woodman (Eds.), *Management articles of the year 2011.* Retrieved from http://eprints.lancs.ac.uk/74449/1/Management_Articles_of_the_Year_June_2012_0.pdf

Alphonse, L. (2014, April 23). New STEM Index finds America's STEM talent pool still too shallow to meet demand: A new U.S. News annual index, sponsored by Raytheon, measures key indicators of STEM activity in the U.S. *U.S. News & World Report.* Retrieved from http://www.usnews.com/news/stem-index/articles/2014/04/23/new-stem-index-finds-americas-stem-talent-pool-still-too-shallow-to-meet-demand?int=9a2908

Ang, S., Van Dyne, L., & Roskstuhl, T. (2015). Cultural intelligence: Origins, conceptualization, evolution, and methodological diversity. In M. J. Gelfand, C. Chiu, & Y. Hong (Eds.), *Handbook of advances in culture and psychology* (Vol. 5, pp. 273-310). Oxford, UK: Oxford University Press.

Avolio, B. J. (2016). Candor and transparency: Aligning your leadership constellation. *People & Strategy, 39*(4), 16-20. Retrieved from https://www.hrps.org/resources/people-strategy-journal/pages/default.aspx

Baby Boomers. (2018). In *Wikipedia, The Free Encyclopedia.* Retrieved from https://en.wikipedia.org/wiki/Baby_boomers

Bainbridge, W. S. (Ed.). (2012). *Leadership in science and technology: A reference handbook* (Vol. 1). Los Angeles, CA: Sage.

Barr, A. B., & Tessler, S. (1996, December 5). The globalization of software R&D: The search for talent. Retrieved from http://web.stanford.edu/group/scip/avsgt/cfr1296.pdf

Bass, B. M. (1985). *Leadership and performance beyond expectations*. New York, NY: Free Press.

Bass, B. M., & Riggio, R. E. (2006). *Transformational leadership.* Mahwah, NJ: Lawrence Erlbaum Associates,

Battaglia, M. P. (2008). Nonprobability sampling. In P. J. Lavrakas (Ed.), *Encyclopedia of survey research methods* (pp. 524-527). Thousand Oaks, CA: Sage.

Beede, D., Julian, T., Langdon, D., McKittrick, G., Khan, B., & Doms, M. (2011, August). Women in STEM: A gender gap to innovation. Retrieved from http://www.esa.doc.gov/reports/women-stem-gender-gap-innovation.

Bennis, W. G., & Biederman, P. W. (1997). *Organizing genius: The secrets of creative collaboration*. Reading, MA: Addison-Wesley.

Bentz, V. M., & Shapiro, J. J. (1998). *Mindful inquiry in social research*. London, UK: Sage Publications.

Berry, J. W. (2008). Globalisation and acculturation. *International Journal of Intercultural Relations, 32*(4), 328-336. https://doi.org/10.1016/j.ijintrel.2008.04.001

Bird, A., & Mendenhall, M. E. (2016). From cross-cultural management to global leadership: Evolution and adaptation. *Journal of World Business, 51*(1), 115-126. https://doi.org/10.1016/j.jwb.2015.10.005

Blackwell, S., Katzen, S., Patel, N., Sun, Y., & Emenike, M. (2017). Developing the preparation in STEM leadership programs for undergraduate academic peer leaders. *The Learning Assistant Review, 22*(1), 50-84. https://doi.org/EJ1142581

Caillaiu, R., & Connolly, D. (2000). A little history of the world wide web. Retrieved from http://www.w3.org/History.html

Cappelli, P. (1996). Technology and skill requirements: Implications for establishment wage structures. *New England Economic Review, May/June*, 139. Retrieved from https://www.bostonfed.org/publications/new-england-economic-review.aspx

Carnevale, A. P., Smith, N., & Melton, M. (2011). *STEM*. Retrieved from https://cew.georgetown.edu/wp-content/uploads/2014/11/stem-complete.pdf

Carroll, M., Lux, H., & Schack, J. (2000). Trading meets the millennium. *Institutional Investor*, *34*(1), 36-53. Retrieved from https://www.institutionalinvestor.com/

Chandrasekaran, R. (1997, November 30). A seller's market for tech jobs. *Washington Post.* Retrieved from http://www.washingtonpost.com/wp-srv/business/longterm/tech/techjob1.htm

Chhokar, J. S., Brodbeck, F. C., & House, R. J. (2007). *Culture and leadership across the world: The GLOBE book of in-depth studies of 25 societies*. Mahwah, NJ: Lawrence Erlbaum Associates.

Chute, E. (2009, February 10). STEM education is branching out: Focus shifts to making science, math accessible to more than just brightest. *Pittsburgh Post-Gazette*. Retrieved

from http://www.post-gazette.com/news/education/2009/02/10/STEM-education-is-branching-out/stories/200902100165

Cohen, J. (1988). Set correlation and contingency tables. *Applied Psychological Measurement*, *12*(4), 425-434. https://doi.org/10.1177/014662168801200410

Colvin, W., Lyden, S., & León de la Barra, B. (2013). Attracting girls to civil engineering through hands-on activities that reveal the communal goals and values of the profession. *Leadership and Management in Engineering, 13*(1), 35-41. https://doi.org/10.1061/(ASCE)LM.1943-5630.0000208

Commager, H. S. (1961). Leadership in eighteenth-century America and today. *Daedalus, 90*(4), 652-673. Retrieved from http://www.jstor.org/stable/20026683

Committee on Equal Opportunities in Science and Engineering. (2001). 2000 biennual report to the United States Congress. Retrieved from http://www.nsf.gov/pubs/2001/ceose2000rpt/congress.pdf

Committee on Integrated STEM Education, National Academy of Engineering, & National Research Council. (2014). STEM integration in K-12 education: Status, prospects, and an agenda for research. Retrieved from http://nap.edu/18612

Cook, L., Mason, M., Morse, R., & Neuhauser, A. (2015, June 29). The annual index measures science, technology, engineering and mathematics activity in the U.S. *U.S. News & World Report.* Retrieved from http://www.usnews.com/news/stem-index/articles/2015/06/29/the-2015-us-news-raytheon-stem-index?int=9a2908

Cooper, J., & Robinson, P. (1997, December). Small-group instruction: An annotated bibliography of science, mathematics, engineering and technology resources in higher

education, 1997. Occasional paper (NISE-OP-6). Retrieved from http://files.eric.ed.gov/fulltext/ED472334.pdf

Cottey, A. (2016). Openness and stability. *AI & Society: Journal of Knowledge, Culture and Communication, 31*(3), 319-325. https://doi.org/10.1007/s00146-015-0592-9

Dasgupta, N., & Stout, J. G. (2014). Girls and women in science, technology, engineering, and mathematics: STEMing the tide and broadening participation in STEM careers. *Policy Insights from the Behavioral and Brain Sciences*, *1*(1), 21-29. https://doi.org/10.1177/2372732214549471

Day, D. V. (2014). *The Oxford handbook of leadership and organizations*. New York, NY: Oxford University Press.

Den Hartog, D. N., House, R. J., Hanges, P. J., Ruiz-Quintanilla, S. A., & Dorfman, P. W. (1999). Culture specific and crossculturally generalizable implicit leadership theories: Are attributes of charismatic/transformational leadership universally endorsed? *Leadership Quarterly, 10*(2), 219-256. https://doi.org/10.1016/s1048-9843(99)00018-1

Dickson, M. W., BeShears, R. S., & Gupta, V. (2004). The impact of societal culture and industry on organizational culture. In R. J. House, P. J. Hanges, M. Javidan, P. W. Dorfman, & V. Gupta (Eds.), *Culture, leadership and organizations: The GLOBE study of 62 societies* (pp. 74-90). Thousand Oaks, CA: Sage Publications.

Dickson, M. W., Castaño, N., Magomaeva, A., & Den Hartog, D. N. (2012). Conceptualizing leadership across cultures. *Journal of World Business, 47*(4), 483-492. https://doi.org/10.1016/j.jwb.2012.01.002

Diekman, A. B., Belanger, A. L., & Weisgram, E. S. (2015). New routes to recruiting and retaining women in STEM: Policy implications of a communal goal congruity

perspective. *Social Issues and Policy Review, 9*(1), 52-88. https://doi.org/10.1111/sipr.12010

Dorfman, P., Javidan, M., Hanges, P., Dastmalchian, A., & House, R. (2012). GLOBE: A twenty year journey into the intriguing world of culture and leadership. *Journal of World Business, 47*(4), 504-518. https://doi.org/10.1016/j.jwb.2012.01.004

Eagly, A. H., & Antonakis, J. (2015). Leadership. In M. Mikulincer, P. R. Shaver, E. Borgida, & J. A. Bargh (Eds.), *APA handbook of personality and social psychology: Attitudes and social cognition* (Vol. 1, pp. 571-592). Washington, DC: American Psychological Association.

Eiser, B. J. A. (2008). In focus/emerging leaders: Meeting the challenge of moving from technical expert to leader. *Leadership in Action, 28*(5), 13-24. https://doi.org/10.1002/lia.1262

Estienne, M. (1997). The art of cross-cultural management: An alternative approach to training and development. *Journal of European Industrial Training, 21*(1), 14-18. https://doi.org/https://doi.org/10.1108/03090599710156393

Executive Office of the President, President's Council of Advisors on Science and Technology. (2012, February). Report to the President: Engage to excel: Producing one million additional college graduates with degrees in science, technology, engineering, mathematics. Retrieved from https://obamawhitehouse.archives.gov/sites/default/files/microsites/ostp/pcast-engage-to-excel-final_2-25-12.pdf

Executive Office of the President of the United States, National Science and Technology Council. (2013, May). Federal science, technology, engineering, and mathematics

(STEM) education 5-year strategic plan: A report from the Committee on STEM Education National Science and Technology Council. Retrieved from http://www.whitehouse.gov/sites/default/files/microsites/ostp/stem_stratplan_2013.pdf

Faul, F., Erdfelder, E., Buchner, A., & Lang, A. G. (2009). Statistical power analyses using G*Power 3.1: Tests for correlation and regression analyses. *Behavior Research Methods, 41*(4), 1149-1160. https://doi.org/10.3758/BRM.41.4.1149

Federal Coordinating Council for Science, Engineering and Technology. (1993, August). The Federal investment in science, mathematics, engineering and technology education: Where now? What next? Sourcebook. Report of the Expert Panel for the Review of Federal Education Programs in Science, Mathematics, Engineering, and Technology. Retrieved from http://files.eric.ed.gov/fulltext/ED366502.pdf

Finn, D., & Donovan, A. (2013). PwC's NextGen: A global generational study: Evolving talent strategy to match the new workforce reality. Summary and compendium of findings. Retrieved from http://www.pwc.com/us/en/people-management/publications/nextgen-global-generational-study.html

Foti, R. J., Hansbrough, T. K., Epitropaki, O., & Coyle, P. T. (2017). Dynamic viewpoints on implicit leadership and followership theories: Approaches, findings, and future directions. *The Leadership Quarterly, 28*(2), 261-267. https://doi.org/10.1016/j.leaqua.2017.02.004

Frank, A. G., Ribeiro, J. L. D., & Echeveste, M. E. (2015). Factors influencing knowledge transfer between NPD teams: A taxonomic analysis based on a sociotechnical approach. *R&D Management, 45*(1), 1-22. https://doi.org/10.1111/radm.12046

G*Power Version 3.1.9.2 [Computer software]. (2014). Retrieved from http://www.gpower.hhu.de/en.html

Gardner, D. P. (1983, April). A nation at risk: The imperative for educational reform. An open letter to the American people. A report to the nation and the Secretary of Education. Retrieved from https://eric.ed.gov/?id=ED226006

Gelbard, R., Carmeli, A., Bittmann, R. M., & Ronen, S. (2009). Cluster analysis using multi-algorithm voting in cross-cultural studies. *Expert Systems with Applications, 36*(7), 10438-10446. https://doi.org/10.1016/j.eswa.2009.01.071

Generation X. (2018). In *Wikipedia: The Free Encyclopedia*. Retrieved from https://en.wikipedia.org/wiki/Generation_X

Gilstrap, J. B., & Collins, B. J. (2012). The importance of being trustworthy: Trust as a mediator of the relationship between leader behaviors and employee job satisfaction. *Journal of Leadership & Organizational Studies, 19*(2), 152-163. https://doi.org/10.1177/1548051811431827

GLOBE Foundation. (n.d.). The GLOBE Project. Retrieved from http://www.globeproject.com

GLOBE Foundation. (2006a). GLOBE Project: GLOBE research survey form beta. Retrieved from http://globeproject.com/data/GLOBE-Phase-2-Alpha-Questionnaire-2006.pdf

GLOBE Foundation. (2006b). Guidelines for the use of GLOBE culture and leadership scales. Retrieved from http://www.uvic.ca/gustavson/globe/assets/docs/GLOBE-Culture-and-Leadership-Scales-Guidelines-Aug-1-2006.pdf

Gonzales, H. B., & Kuenzi, J. J. (2012). Science, technology, engineering, and mathematics (STEM) education: A primer (R42642). Retrieved from https://www.stem.org/cm/dpl/downloads/content/69/R42642.pdf

Gonzalez-Loureiro, M., Kiessling, T., & Dabic, M. (2015). Acculturation and overseas assignments: A review and research agenda. *International Journal of Intercultural Relations, 49*, 239-250. https://doi.org/http://dx.doi.org/10.1016/j.ijintrel.2015.05.003

Gunn, K. (1998). Don't get bitten by the Y2K. *National Petroleum News, 90*(6), 55.

Gupta, A. K., & Govindarajan, V. (2002). Cultivating a global mindset. *Academy of Management Executive, 16*(1), 116-126. https://doi.org/10.5465/AME.2002.6640211

Gupta, V., & Hanges, P. J. (2004). Regional and climate clustering of societal clusters. In R. J. House, P. J. Hanges, M. Javidan, P. W. Dorfman, & V. Gupta (Eds.), *Culture, leadership and organizations: The GLOBE study of 62 societies* (pp. 178–218). Thousand Oaks: CA: Sage Publications.

Gupta, V., Hanges, P. J., & Dorfman, P. (2002). Cultural clusters: Methodology and findings. *Journal of World Business, 37*(1), 11-15. https://doi.org/10.1016/S1090-9516(01)00070-0

H-1B and L-1 Visa Reform Act of 2017, H.R. 1303, 115th, cong. (2017).

Hanges, P. J., & Dickson, M. W. (2004). The development and validation of the GLOBE culture and leadership scales. In R. J. House, P. J. Hanges, M. Javidan, P. W. Dorfman, & V. Gupta (Eds.), *Culture, leadership, and organizations: The GLOBE Study of 62 societies* (pp. 122-151). Thousand Oaks, CA: Sage Publications.

Hanges, P. J., & Dickson, M. W. (2006). Agitation over aggregation: Clarifying the development of and the nature of the GLOBE scales. *The Leadership Quarterly, 17*(5), 522-536. https://doi.org/http://dx.doi.org/10.1016/j.leaqua.2006.06.004

Hartmann, B. L., & Jahren, C. T. (2015). Leadership: industry needs for entry-level engineering positions. *Journal of STEM Education: Innovations and Research, 16*(3), 13-19. https://doi.org/10.18260/p.24784

Hill, R. P., & Stephens, D. L. (2003). The compassionate organization in the 21st century. *Organizational Dynamics, 32*(4), 331-341. https://doi.org/10.1016/j.orgdyn.2003.08.004

Hofstede, G. (1995). Multilevel research of human systems: Flowers, bouquets and gardens. *Human Systems Management, 14*(3), 207. https://doi.org/10.3233/HSM-1995-14304

Hofstede, G. H. (1980). *Culture's consequences: International differences in work-related values*. Beverly Hills, CA: Sage Publications.

Hofstede, G. H., Hofstede, G. J., & Minkov, M. (2010). *Cultures and organizations: Software of the mind: Intercultural cooperation and its importance for survival*. New York, NY: McGraw-Hill.

Hourihan, M., & Parkes, D. (2018, March 23). Omnibus would provide the largest research increase in nearly a decade: Biomedical, energy, space, defense, and other research programs would see increases in some cases sizable, if the President signs the proposed omnibus. Retrieved from https://www.aaas.org/news/omnibus-would-provide-largest-research-increase-nearly-decade

House, R. J., & Aditya, R. N. (1997). The social scientific study of leadership: Quo vadis? *Journal of Management*, *23*(3), 409-473.

House, R. J., Dorfman, P. W., Javidan, M., Hanges, P., J., & Sully de Luque, M. F. (2014). *Strategic leadership across cultures: The GLOBE study of CEO leadership behavior and effectiveness in 24 countries*. Los Angeles, CA: Sage.

House, R. J., Hanges, P. J., Javidan, M., Dorfman, P. W., & Gupta, V. (Eds.). (2004). *Culture, leadership, and organizations: The GLOBE study of 62 societies.* Thousand Oaks, CA: Sage Publications.

House, R., Javidan, M., Hanges, P., & Dorfman, P. (2002). Understanding cultures and implicit leadership theories across the globe: An introduction to project GLOBE. *Journal of World Business, 37*(1), 3-10. https://doi.org/10.1016/S1090-9516(01)00069-4

IBM Corp. (2014). IBM statistical package for social sciences Version 22.0 [Computer software]. Armonk, NY: IBM Corp.

Immigration Innovation Act of 2015, S. 153, 114th cong. (2015).

Information Technology Industry Council, Partnership for a New American Economy, & U.S. Chamber of Commerce. (2012). Help wanted: The role of foreign workers in the innovation economy. Retrieved from http://www.renewoureconomy.org/sites/all/themes/pnae/stem-report.pdf

International Space Exploration Coordination Group. (2013, September). Benefits stemming from space exploration. Retrieved from https://www.nasa.gov/sites/default/files/files/Benefits-Stemming-from-Space-Exploration-2013-TAGGED.pdf

Javidan, M. (2004). Performance orientation. In R. J. House, P. J. Hanges, M. Javidan, P. W. Dorfman, & V. Gupta (Eds.), *Culture, leadership, and organizations: The GLOBE study of 62 societies* (pp. 513-563). Thousand Oaks, CA: Sage Publications.

Javidan, M., & Bowen, D. (2013). The global mindset of managers. *Organizational Dynamics, 42*(2), 145-155. https://doi.org/10.1016/j.orgdyn.2013.03.008

Javidan, M., Dorfman, P. W., Sully de Luque, M., & House, R. J. (2006). In the eye of the beholder: Cross cultural lessons in leadership from project GLOBE. *Academy of Management Perspectives, 20*(1), 67-90. https://doi.org/10.5465/AMP.2006.19873410

Javidan, M., Sully de Luque, M., Dorfman, P. W., & House, R. J. (2006). In the eye of the beholder: Cross cultural lessons in leadership from project GLOBE. *Academy of Management Perspectives, 20*(1), 67-90. https://doi.org/10.5465/amp.2006.19873410

Jobs for the Future. (2007, April). The STEM workforce challenge: The role of the public workforce system in a national solution for a competitive science, technology, engineering, and mathematics (STEM) workforce. Retrieved from http://purl.access.gpo.gov/GPO/LPS94941

Kamin, M. (2013). Soft skills revolution: A guide for connecting with compassion for trainers, teams, and leaders. Retrieved from http://public.eblib.com/choice/publicfullrecord.aspx?p=821796

Klaussner, S. (2012). Trust and leadership: Toward an interactive perspective. *Journal of Change Management, 12*(4), 417-439. https://doi.org/10.1080/14697017.2012.728766

Kouzes, J. M., & Posner, B. Z. (2011). *The five practices of exemplary leadership.* New York, NY: Wiley.

Kraska-Miller, M. (2014). *Nonparametric statistics for social and behavioral sciences.* Boca Raton, FL: CRC Press.

Lehmann, E. L. (1998, May 15). *Nonparametrics: Statistical methods based on ranks, Revised* (Facsimile ed.). Upper Saddle River, NY: Pearson Education.

Li, M., Mobley, W. H., & Kelly, A. (2016). Linking personality to cultural intelligence: An interactive effect of openness and agreeableness. *Personality and Individual Differences, 89*, 105-110. https://doi.org/10.1016/j.paid.2015.09.050

Lord, R. G., Day, D. V., Zaccaro, S. J., Avolio, B. J., & Eagly, A. H. (2017). Leadership in applied psychology: Three waves of theory and research. *Journal of Applied Psychology, 102*(3), 434-451. https://doi.org/10.1037/apl0000089

Lord, R. G., de Vader, C. L., & Alliger, G. M. (1986). A meta-analysis of the relation between personality traits and leadership perceptions: An application of validity generalization procedures. *Journal of Applied Psychology, 71*(3), 402-410. https://doi.org/10.1037/0021-9010.71.3.402

Lord, R. G., & Dinh, J. E. (2014). What have we learned that is critical in understanding leadership perceptions and leader-performance relations? *IOPS Industrial and Organizational Psychology, 7*(2), 158-177. https://doi.org/10.1111/iops.12127

Lord, R. G., & Emrich, C. G. (2000). Thinking outside the box by looking inside the box: Extending the cognitive revolution in leadership research. *The Leadership Quarterly, 11*(4), 551-579. https://doi.org/10.1016/S1048-9843(00)00060-6

Lord, R. G., & Maher, K. J. (1991). *Leadership and information processing: Linking perceptions and performance*. Boston, MA: Unwin Hyman.

LRN. (2016). The HOW Report: A global empirical analysis of how governance, culture and leadership impact performance. Retrieved from http://howmetrics.lrn.com/wp/wp-content/uploads/2016/05/HOW-REPORT-5-6-16.pdf

Mann, A., & Nunes, T. (2009). After the dot-com bubble: Silicon Valley high-tech employment and wages in 2001 and 2008. Retrieved from http://www.bls.gov/opub/regional_reports/200908_silicon_valley_high_tech.htm

Maseland, R., & van Hoorn, A. (2009). Measuring values for cross-cultural research. Retrieved from https://www.researchgate.net/publication/242549454_Measuring_values_for_cross-cultural_research

McAlpine, L. (2016). Becoming a PI: From "doing" to "managing" research. *Teaching in Higher Education, 21*(1), 49-63. https://doi.org/10.1080/13562517.2015.1110789

McClelland, D. C. (1985). *Human motivation*. Glenview, IL: Scott, Foresman.

Millennials. (2018). In *Wikipedia, The Free Encyclopedia*. Retrieved from https://en.wikipedia.org/wiki/Millennials

Minkov, M. (2013). *The elements of culture. Cross-cultural analysis: The science and art of comparing the world's modern societies and their cultures*. Thousand Oaks, CA: SAGE Publications.

Minkov, M., & Hofstede, G. (2011). The evolution of Hofstede's doctrine. *Cross Cultural Management: An International Journal, 18*(1), 10-20. https://doi.org/10.1108/13527601111104269

Minkov, M., & Hofstede, G. (2012). Is national culture a meaningful concept? Cultural values delineate homogeneous national clusters of in-country regions. *Cross-Cultural Research, 46*(2). https://doi.org/10.1177/1069397111427262

Moan, K., & Hetland, H. (2012). Are leadership preferences universally endorsed or culturally contingent? *Scandinavian Journal of Organizational Psychology*, *4*(2), 5-22.

Modi, K., Schoenberg, J., & Salmond, K. (2012). Generation STEM: What girls say about science, technology, engineering, and math. Retrieved from http://www.girlscouts.org/content/dam/girlscouts-gsusa/forms-and-documents/about-girl-scouts/research/generation_stem_full_report.pdf

Mosisa, A. T. (2002, May). The role of foreign-born workers in the U. S. economy. Retrieved from http://www.bls.gov/opub/mlr/2002/05/art1full.pdf

Nardon, L., & Steers, R. M. (2008). The new global manager: Learning cultures on the fly. *Organizational Dynamics, 37*(1), 47-59. https://doi.org/10.1016/j.orgdyn.2007.11.006

National Academies Committee on Prospering in the Global Economy of the 21st Century. (2005). Rising above the gathering storm: Energizing and employing America for a brighter economic future. https://doi.org/10.17226/11463

National Academy of Sciences, National Academy of Engineering, & Institute of Medicine. (2010). *Rising above the gathering storm, revisited: Rapidly approaching category 5*. Retrieved from http://www.ncbi.nlm.nih.gov/books/NBK259118/

National Girls Collaborative Project. (2017, August). The state of girls and women in STEM. Retrieved from http://ngcproject.org/sites/default/files/ngcp_the_state_of_girls_and_women_in_stem_2017a.pdf

National Research Council, Center for Science, Mathematics, and Engineering Education. (1996). From analysis to action: Undergraduate education in science, mathematics, engineering, and technology. Report of a convocation. Retrieved from http://www.nap.edu/read/9128/

National Science Board. (2018a). Higher education in science and engineering (NSB-2018-1). Retrieved from https://www.nsf.gov/statistics/2018/nsb20181/report

National Science Board. (2018b). Our nation's future competitiveness relies on building a STEM-capable U.S. workforce: A policy companion statement to science and engineering

indicators 2018 (NSB-2018-7). Retrieved from https://www.nsf.gov/nsb/sei/companion-brief/NSB-2018-7.pdf

National Science Board. (2018c). Research and development: National trends and international comparisons (NSB-2018-1). Retrieved from https://www.nsf.gov/statistics/2018/nsb20181/report

National Science Board. (2018d). Science & engineering indicators 2018 (NSB-2018-1). Retrieved from http://www.nsf.gov/statistics/2018/nsb20181/

National Science Board. (2018e). Science and engineering labor force (NSB-2018-1). Retrieved from https://www.nsf.gov/statistics/2018/nsb20181/report

National Science Foundation. (n.d.). Find funding. Retrieved from http://www.nsf.gov/funding/

National Science Foundation. (2017). Scientists and engineers statistical data system (SESTAT). Retrieved from http://www.nsf.gov/statistics/sestat/

National Science Foundation, Directorate for Education and Human Resources, Division of Undergraduate Education. (1998). Information technology: Its impact on undergraduate education in science, mathematics, engineering, and technology (NSF 98-82). Retrieved from http://www.nsf.gov/pubs/1998/nsf9882/nsf9882.pdf

Nayar, S. (2015). Resituating models of acculturation: An occupational dimension. *Journal of International Migration and Integration, 16*(4), 1141-1155. https://doi.org/10.1007/s12134-014-0379-8

No Child Left Behind Act of 2001, H.R. 1, 107th cong. (2001) (enacted).

Noonan, R. (2017). STEM jobs: 2017 update (ESA Issue Brief No. 02-17). Retrieved from http://www.esa.doc.gov/sites/default/files/stem-jobs-2017-update.pdf

National Research Council of the National Academies. (2014). *STEM learning is everywhere: Summary of a convocation on building learning systems*. Washington, DC: National Academies Press.

Patterson, A. (2015). *Leader evolution: From technical expertise to strategic leadership*. New York, NY: Business Expert Press.

Peterson, M. F., & Castro, S. L. (2006). Measurement metrics at aggregate levels of analysis: Implications for organization culture research and the GLOBE project. *The Leadership Quarterly, 17*(5), 506-521. https://doi.org/10.1016/j.leaqua.2006.07.001

Pfeffer, J. (2007). *The human equation: Building profits by putting people first*. Boston, MA: Harvard Business School Press.

Promoting Women in Entrepreneurship Act, S. 83, 115th cong. (2017).

Protection of Human Subjects, 45, C.F.R. 46. (2009).

Pucik, V., Tichy, N. M., & Barnett, C. K. (1992). *Globalizing management: Creating and leading the competitive organization*. New York, NY: Wiley.

Roach, J. (2013). Eight great American discoveries in science. Retrieved from http://www.nbcnews.com/id/38158710/ns/technology_and_science-science/t/eight-great-american-discoveries-science/#.Vm3ojEorJD8

Roberts, P. (2001). *The Cold War*. London, UK: The History Press.

Ronen, S., & Shenkar, O. (2013). Mapping world cultures: Cluster formation, sources and implications. *Journal of International Business Studies, 44*(9), 867-897. https://doi.org/10.1057/jibs.2013.42

Ruben, B. D., & Gigliotti, R. A. (2016). Leadership as social influence: An expanded view of leadership communication theory and practice. *Journal of Leadership & Organizational Studies, 23*(4), 467-479. https://doi.org/10.1177/1548051816641876

Rush, M. C., Thomas, J. C., & Lord, R. G. (1977). Implicit leadership theory: A potential threat to the internal validity of leader behavior questionnaires. *Organizational Behavior and Human Performance, 20*(1), 93-110. https://doi.org/10.1016/0030-5073(77)90046-0

Sasaki, I., & Yoshikawa, K. (2014). Going beyond national cultures – Dynamic interaction between intra-national, regional, and organizational realities. *Journal of World Business, 49*(3), 455-464. https://doi.org/10.1016/j.jwb.2013.10.005

Society for Human Resource Management Foundation. (2015, May 20). Executive roundtable summary: Engaging and integrating a global workforce. Retrieved from https://www.shrm.org/about/foundation/shapingthefuture/documents/7-15%20global%20roundtable%20summary.pdf

Sincerity. (n.d.). In *Merriam Webster online*. Retrieved from https://www.merriam-webster.com/dictionary/sincerity

STEM Education Act of 2015, H.R. 1020, 114th cong. (2015) (enacted).

Sterba, S. K., & Foster, E. M. (2008). Self-selected sample. In P. J. Lavrakas (Ed.), *Encyclopedia of Survey Research Methods* (pp. 807-809). Thousand Oaks, CA: Sage.

Stuller, J. (2000). Ready for the other millennium bomb? Businesses squashed the Y2K bug without breaking a sweat, but a new obstacle looms ahead-the dramatic demographic shift decimating today's pool of leadership talent. *Chief Executive, 157*, 48-54. Retrieved from https://chiefexecutive.net

Townley, A. J., Schmieder-Ramirez, J. H., & Wehmeyer, L. B. (2005). *School finance: A California perspective*. Dubuque, IA: Kendall/Hunt.

Triandis, H. C. (1995). *Individualism & collectivism*. Boulder, CO: Westview Press.

Trump, D. J. (2017, December). National security strategy of the United States. Retrieved from https://www.whitehouse.gov/wp-content/uploads/2017/12/NSS-Final-12-18-2017-0905-2.pdf

U.S. Census Bureau. (n.d.). American community survey. Retrieved from https://www.census.gov/programs-surveys/acs/about/acs-and-census.html

U.S. Citizenship and Immigration Services. (2015, April 13). USCIS completes the H-1B cap random selection process for FY 2016 [Press release]. Retrieved from https://www.uscis.gov/news/alerts/uscis-completes-h-1b-cap-random-selection-process-fy-2016

U.S. Citizenship and Immigration Services. (2016, April 7). H-1B fiscal year (FY) 2017 cap season. Retrieved from https://www.uscis.gov/working-united-states/temporary-workers/h-1b-specialty-occupations-and-fashion-models/h-1b-fiscal-year-fy-2017-cap-season

U.S. Chamber of Commerce, Economics and Statistics Administration. (2017). Women in STEM: 2017 Update. Retrieved from http://www.esa.doc.gov/sites/default/files/women-in-stem-2017-update.pdf

U.S. Congress. (1997). *The state of science, math, engineering, and technology education (SMET) in America, parts I-IV, including the results of the Third International Mathematics and Science Study (TIMSS) hearings before the Committee on Science, U.S.*

House of Representatives, One Hundred Fifth Congress, first session. July 23, September 24, October 8 and 29, 1997. Washington, DC: U.S. G.P.O.

U.S. Department of Education. (2015). Science, technology, engineering and math: Education for global leadership. Retrieved from http://www.ed.gov/stem

U.S. Department of Education. (2018). FY 2017 annual performance report and FY 2019 annual performance plan. Retrieved from https://www2.ed.gov/about/reports/annual/2019plan/fy17apr-fy19app.pdf

U.S. Department of Education, Academic Improvement and Teacher Quality Programs. (2015). Federal agencies collaborate to improve after-school science, technology, engineering and math (STEM) education [Press release]. Retrieved from http://www.ed.gov/news/press-releases/federal-agencies-collaborate-improve-after-school-science-technology-engineering-and-math-stem-education

U.S. Department of Homeland Security. (2016). Improving and expanding training opportunities for F-1 nonimmigrant students with STEM degrees and cap-gap relief for all eligible F-1 students, 8 C.F.R. § 214 and 274a. Retrieved from https://www.federalregister.gov/documents/2016/03/11/2016-04828/improving-and-expanding-training-opportunities-for-f-1-nonimmigrant-students-with-stem-degrees-and

U.S. Department of Homeland Security, U.S. Citizenship and Immigration Services. (2015a). Entrepreneur visa guide. Retrieved from http://www.uscis.gov/eir/visa-guide/entrepreneur-visa-guide

U.S. Department of Homeland Security, U.S. Citizenship and Immigration Services. (2015b). Official website of the U.S. Department of Homeland Security: U.S. Citizenship and Immigration Services. Retrieved from http://www.uscis.gov/

U.S. Department of Homeland Security, U.S. Immigration and Customs Enforcement. (2016). Student and exchange visitor information system: SEVIS by the numbers: General summary quarterly review. Retrieved from https://www.ice.gov/sites/default/files/documents/Report/2016/sevis-bythenumbers-0416.pdf

U.S. Department of Labor, Bureau of Labor Statistics. (2008). Foreign-born workers: Labor force characteristics - 2007 [Press release]. Retrieved from www.bls.gov/news.release/archives/forbrn_03262008.pdf

U.S. Department of Labor, Bureau of Labor Statistics. (2009). Foreign-born workers: Labor force characteristics - 2008 [Press release]. Retrieved from www.bls.gov/news.release/archives/forbrn_03262009.pdf

U.S. Department of Labor, Bureau of Labor Statistics. (2010a). Foreign-born workers: Labor force characteristics - 2009 [Press release]. Retrieved from www.bls.gov/news.release/archives/forbrn_03192010.pdf

U.S. Department of Labor, Bureau of Labor Statistics. (2010b). Standard occupational classification. Retrieved from http://www.bls.gov/soc/

U.S. Department of Labor, Bureau of Labor Statistics. (2011). Foreign-born workers: Labor force characteristics - 2010 [Press release]. Retrieved from www.bls.gov/news.release/archives/forbrn_05272011.pdf

U.S. Department of Labor, Bureau of Labor Statistics. (2012a). Foreign-born workers: Labor force characteristics - 2011 [Press release]. Retrieved from http://www.bls.gov/news.release/archives/forbrn_05242012.htm

U.S. Department of Labor, Bureau of Labor Statistics. (2012b). Occupational employment statistics highlights - Architecture and engineering. Retrieved from http://www.bls.gov/oes/highlight_arch_eng.pdf.

U.S. Department of Labor, Bureau of Labor Statistics. (2013). Foreign-born workers: Labor force characteristics - 2012 [Press release]. Retrieved from www.bls.gov/news.release/archives/forbrn_05222013.pdf

U.S. Department of Labor, Bureau of Labor Statistics. (2014). Foreign-born workers: Labor force characteristics - 2013 [Press release]. Retrieved from www.bls.gov/news.release/archives/forbrn_05222014.pdf

U.S. Department of Labor, Bureau of Labor Statistics. (2015a). Employment projections: 2014-24 news release [Press release]. Retrieved from https://www.bls.gov/news.release/archives/ecopro_12082015.htm

U.S. Department of Labor, Bureau of Labor Statistics. (2015b). Foreign-born workers: Labor force characteristics - 2014 [Press release]. Retrieved from http://www.bls.gov/news.release/forbrn.nr0.htm

U.S. Department of Labor, Bureau of Labor Statistics. (2015c). Projections of occupational employment, 2014-24. Retrieved from https://www.bls.gov/careeroutlook/2015/article/projections-occupation.htm

U.S. Department of Labor, Bureau of Labor Statistics. (2015d). STEM crisis or STEM surplus? Yes and yes. *Monthly Labor Review*. Retrieved from http://www.bls.gov/opub/mlr/2015/article/stem-crisis-or-stem-surplus-yes-and-yes.htm

U.S. Department of Labor, Bureau of Labor Statistics. (2016a). Foreign-born workers: Labor force characteristics - 2015 [Press release]. Retrieved from http://www.bls.gov/news.release/forbrn.nr0.htm

U.S. Department of Labor, Bureau of Labor Statistics. (2016b). Occupational employment statistics. Retrieved from www.bls.gov/oes/

U.S. Department of Labor, Bureau of Labor Statistics. (2017a). Employment projections and Occupational Outlook Handbook news release [Press release]. Retrieved from https://www.bls.gov/news.release/archives/ecopro_12082015.pdf

U.S. Department of Labor, Bureau of Labor Statistics. (2017b). Foreign-born workers: Labor force characteristics - 2016 [Press release]. Retrieved from https://www.bls.gov/news.release/forbrn.nr0.htm

U.S. Department of Labor, Bureau of Labor Statistics. (2017c). Labor force statistics from the current population survey. Retrieved from https://www.bls.gov/cps/cps_over.htm

U.S. Department of Labor, Bureau of Labor Statistics. (2018a). Employment by major occupational group. Retrieved from https://www.bls.gov/emp/ep_table_101.htm

U.S. Department of Labor, Bureau of Labor Statistics. (2018b). Employment projections - 2016-26. Retrieved from http://www.bls.gov/emp/#tables

U.S. Department of Labor, Bureau of Labor Statistics. (2018c). Occupational outlook handbook. Retrieved from https://www.bls.gov/ooh/home.htm

U.S. Census Bureau. (2014, July 10). Census Bureau reports majority of STEM college graduates do not work in STEM occupations [Press release]. Retrieved from http://www.census.gov/newsroom/press-releases/2014/cb14-130.html

U.S. Senate Special Committee on the Year 2000 Technology Problem. (2000). Y2K aftermath - crisis averted: Final committee report: Summary of committee findings. Retrieved from http://permanent.access.gpo.gov/lps90964/y2kfinalreport.pdf.

Vilorio, D. (2014, Spring). STEM 101: Intro to tomorrow's jobs. Retrieved from http://www.bls.gov/careeroutlook/2014/spring/art01.pdf

von Krogh, G., Nonaka, I., & Rechsteiner, L. (2012). Leadership in organizational knowledge creation: A review and framework. *Journal of Management Studies, 49*(1), 240-277. https://doi.org/10.1111/j.1467-6486.2010.00978.x

Walls, M. E. (2000). The "undisciplined," interdisciplinary problem: PBL and the expanding limits of SMET education. *Journal of STEM Education: Innovations and Research, 1*(3), 33-36. Retrieved from http://jstem.org/index.php/JSTEM/article/view/1189

Ward, C. (2008). Thinking outside the Berry boxes: New perspectives on identity, acculturation and intercultural relations. *International Journal of Intercultural Relations, 32*(2), 105-114. https://doi.org/10.1016/j.ijintrel.2007.11.002

Washington, G. (1790, January 8). From George Washington to the United States Senate and House of Representatives, 8 January 1790. Retrieved from http://founders.archives.gov/documents/Washington/05-04-02-0361

White House Office of Science and Technology Policy. (2015, February). Investing in America's future: Preparing students with STEM skills. Science, technology, engineering, and mathematics (STEM) education in the 2016 budget. Retrieved from https://obamawhitehouse.archives.gov/sites/default/files/microsites/ostp/stem_fact_sheet_2016_budget_0.pdf

White House Office of Science and Technology Policy. (2016, February). STEM for all: Ensuring high-quality STEM education opportunities for all students. Science, technology, engineering, and mathematics (STEM) education in the 2017 budget. Retrieved from https://obamawhitehouse.archives.gov/sites/default/files/microsites/ostp/stem_fact_sheet_2017_budget_final.pdf

Wilderom, C., Den Hartog, D., House, R., Hanges, P., Ruiz-Quintanilla, S. A., & Dorfman, P. (1999). Culture specific and cross-culturally generalizable implicit leadership theories: Are attributes of charismatic/transformational leadership universally endorsed? *Leadership Quarterly, 10*(2), 219-256. https://doi.org/10.1016/S1048-9843(99)00018-1

World Values Survey Association. (2014). World Values Survey wave 6 official aggregate v. 20150418 (2010-2014). Retrieved from http://www.worldvaluessurvey.org/WVSDocumentationWV6.jsp

Yeganeh, H. (2013). A compound index of cultural dimensions: implications and applications. *International Journal of Organizational Analysis, 21*(1), 53-65. https://doi.org/https://doi.org/10.1108/19348831311322533

APPENDIX A

GLOBE Research Survey Form Beta, Sections 2 and 4

GLOBE

Research Survey

GLOBE Project

(Global Leadership and Organizational Behavior Effectiveness Project)

Form Beta

Introduction

The purpose of this research is to learn about national cultures, management practices, and perceptions of leadership. The questionnaire that you are asked to complete will take about one hour of your time.

The resulting information will be useful for individuals who conduct business or government relations with the countries' studies. This information may be used for classroom instruction of students and managers in universities, technological institutes, and other societies throughout the world. Hopefully, this information will be helpful to better understand business and leadership in other cultures.

In the following pages, you are asked to choose a number of statements that reflect your observations of cultural or societal practices, your beliefs, your values, or your perceptions. This is not a test, and there are no right or wrong answers. We are mainly interested in learning about the beliefs and values in your society, and how various societal and societal practices are perceived by you and the others participating in this research. Your responses will be kept completely confidential. No individual respondent will be identified to any other person or in any written form. Further, the name of your society will not be publicly released.

The purpose of this research is to learn about national cultures, management practices, and perceptions of leadership. The questionnaire that you are asked to complete will take about one hour of your time.

The resulting information will be useful for individuals who conduct business or government relations with the countries studied. This information may be used for classroom instruction of students and managers in universities, technological institutes, and other societies throughout the world. Hopefully, this information will be helpful to better understand business and leadership in other cultures.

In the following pages, you are asked to choose a number of statements that reflect your observations of cultural or societal practices, your beliefs, your values, or your perceptions. This is not a test, and there are no right or wrong answers. We are mainly interested in learning about the beliefs and values in your society, and how various societal and societal practices are perceived by you and the others participating in this research. Your responses will be kept completely confidential. No individual respondent will be identified to any other person or in any written form. Further, the name of your organization will not be publicly released.

Sections 2 and 4 have a different type of question. For these sections, you are given a list of behaviors and characteristics that a leader might display. You are asked to rate these behaviors and characteristics using the scale shown below. To do this, on the line next to each behavior or characteristic write the number from the scale that best describes how displaying that behavior or characteristic affects the leader's effectiveness.

SCALE

1= This behavior or characteristic **greatly inhibits** a person from being an outstanding leader.
2= This behavior or characteristic **somewhat inhibits** a person from being an outstanding leader.
3= This behavior or characteristic **slightly inhibits** a person from being an outstanding leader.
4= This behavior or characteristic **has no impact** on whether a person is an outstanding leader.
5= This behavior or characteristic **contributes slightly** to a person being an outstanding leader.
6= This behavior or characteristic **contributes somewhat** to a person being an outstanding leader.
7= This behavior or characteristic **contributes greatly** to a person being an outstanding leader.

An example is shown below. If you believed that being tall inhibited a person from being an outstanding leader, you would write 1, 2, or 3 on the line to the left of "Tall," depending on how much you thought being tall inhibited outstanding leadership. If you believed that being tall contributes to a person's being an outstanding leader, you would write 5, 6, or 7 on the line to the left of "Tall," depending on how much you thought being tall contributed to outstanding leadership. Finally, if you believed that being tall had no effect on whether a person was an outstanding leader, you would write 4 on the line to the left of "Tall."

___ A. Tall = Of significantly above average height

Section 2 — Leader Behaviors

Instructions

You are probably aware of people in your organization or industry who are exceptionally skilled at motivating, influencing, or enabling you, others, or groups to contribute to the success of the organization or task.

In this country, we might call such people "outstanding leaders."

On the following pages are several behaviors and characteristics that can be used to describe leaders. Each behavior or characteristic is accompanied by a short definition to clarify its meaning.

Using the above description of outstanding leaders as a guide, rate the behaviors and characteristics on the following pages. To do this, on the line next to each behavior or characteristic write the number from the scale below that best describes how important that behavior or characteristic is for a leader to be outstanding.

SCALE

1= This behavior or characteristic **greatly inhibits** a person from being an outstanding leader.
2= This behavior or characteristic **somewhat inhibits** a person from being an outstanding leader.
3= This behavior or characteristic **slightly inhibits** a person from being an outstanding leader.
4= This behavior or characteristic **has no impact** on whether a person is an outstanding leader.
5= This behavior or characteristic **contributes slightly** to a person being an outstanding leader.
6= This behavior or characteristic **contributes somewhat** to a person being an outstanding leader.
7= This behavior or characteristic **contributes greatly** to a person being an outstanding leader.

Section 2 questions start here.

___ 2-1 Diplomatic = Skilled at interpersonal relations, tactful

___ 2-2 Evasive = Refrains from making negative comments to maintain good relationships and save face

___ 2-3 Mediator = Intervenes to solve conflicts between individuals

___ 2-4 Bossy = Tells subordinates what to do in a commanding way

___ 2-5 Positive = Generally optimistic and confident

___ 2-6 Intra-group competitor = Tries to exceed the performance of others in his or her group

___ 2-7 Autonomous = Acts independently, does not rely on others

SCALE

1= This behavior or characteristic **greatly inhibits** a person from being an outstanding leader.
2= This behavior or characteristic **somewhat inhibits** a person from being an outstanding leader.
3= This behavior or characteristic **slightly inhibits** a person from being an outstanding leader.
4= This behavior or characteristic **has no impact** on whether a person is an outstanding leader.
5= This behavior or characteristic **contributes slightly** to a person being an outstanding leader.
6= This behavior or characteristic **contributes somewhat** to a person being an outstanding leader.
7= This behavior or characteristic **contributes greatly** to a person being an outstanding leader.

	Characteristic or Behavior		Definition
___	2-8 Independent	=	Does not rely on others; self-governing
___	2-9 Ruthless	=	Punitive; Having no pity or compassion
___	2-10 Tender	=	Easily hurt or offended
___	2-11 Improvement-oriented	=	Seeks continuous performance improvement
___	2-12 Inspirational	=	Inspires emotions, beliefs, values, and behaviors of others, inspires others to be motivated to work hard
___	2-13 Anticipatory	=	Anticipates, attempts to forecast events, considers what will happen in the future
___	2-14 Risk taker	=	Willing to invest major resources in endeavors that do not have high probability of successful
___	2-15 Sincere	=	Means what he/she says, earnest
___	2-16 Trustworthy	=	Deserves trust, can be believed and relied upon to keep his/her word
___	2-17 Worldly	=	Interested in temporal events, has a world outlook
___	2-18 Intra-group conflict avoider	=	Avoids disputes with members of his or her group
___	2-19 Administratively skilled	=	Able to plan, organize, coordinate and control work of large numbers (over 75) of individuals
___	2-20 Just	=	Acts according to what is right or fair
___	2-21 Win/win problem-solver	=	Able to identify solutions which satisfy individuals with diverse and conflicting interests
___	2-22 Clear	=	Easily understood
___	2-23 Self-interested	=	Pursues own best interests
	2-24 Tyrannical	=	Acts like a tyrant or despot; imperious

SCALE

1= This behavior or characteristic **greatly inhibits** a person from being an outstanding leader.
2= This behavior or characteristic **somewhat inhibits** a person from being an outstanding leader.
3= This behavior or characteristic **slightly inhibits** a person from being an outstanding leader.
4= This behavior or characteristic **has no impact** on whether a person is an outstanding leader.
5= This behavior or characteristic **contributes slightly** to a person being an outstanding leader.
6= This behavior or characteristic **contributes somewhat** to a person being an outstanding leader.
7= This behavior or characteristic **contributes greatly** to a person being an outstanding leader.

	Characteristic or Behavior		Definition
___	2-25 Integrator	=	Integrates people or things into cohesive, working whole
___	2-26 Calm	=	Not easily distressed
___	2-27 Provocateur	=	Stimulates unrest
___	2-28 Loyal	=	Stays with and supports friends even when they have substantial problems or difficulties
___	2-29 Unique	=	An unusual person, has characteristics of behaviors that are different from most others
___	2-30 Collaborative	=	Works jointly with others
___	2-31 Encouraging	=	Gives courage, confidence or hope through reassuring and advising
___	2-32 Morale booster	=	Increases morale of subordinates by offering encouragement, praise, and/or by being confident
___	2-33 Arrogant	=	Presumptuous or overbearing
___	2-34 Orderly	=	Is organized and methodological in work
___	2-35 Prepared	=	Is ready for future events
___	2-36 Autocratic	=	Makes decisions in dictatorial way
___	2-37 Secretive	=	Tends to conceal information from others
___	2-38 Asocial	=	Avoids people or groups, prefers own company
___	2-39 Fraternal	=	Tends to be a good friend of subordinates
___	2-40 Generous	=	Willing to give time, money, resources and help to others
___	2-41 Formal	=	Acts in accordance with rules, convention and ceremonies

SCALE

1= This behavior or characteristic **greatly inhibits** a person from being an outstanding leader.
2= This behavior or characteristic **somewhat inhibits** a person from being an outstanding leader.
3= This behavior or characteristic **slightly inhibits** a person from being an outstanding leader.
4= This behavior or characteristic **has no impact** on whether a person is an outstanding leader.
5= This behavior or characteristic **contributes slightly** to a person being an outstanding leader.
6= This behavior or characteristic **contributes somewhat** to a person being an outstanding leader.
7= This behavior or characteristic **contributes greatly** to a person being an outstanding leader.

	Characteristic or Behavior		Definition
___	2-42 Modest	=	Does not boast, presents self in a humble manner
___	2-43 Intelligent	=	Smart, learns and understands easily
___	2-44 Decisive	=	Makes decisions firmly and quickly
___	2-45 Consultative	=	Consults with others before making plans or taking action
___	2-46 Irritable	=	Moody; easily agitated
___	2-47 Loner	=	Works and acts separately from others
___	2-48 Enthusiastic	=	Demonstrates and imparts strong positive emotions for work
___	2-49 Risk averse	=	Avoids taking risks, dislikes risk
___	2-50 Vindictive	=	Vengeful; seeks revenge when wronged
___	2-51 Compassionate	=	Has empathy for others, inclined to be helpful or show mercy
___	2-52 Subdued	=	Suppressed, quiet, tame
___	2-53 Egocentric	=	Self-absorbed, thoughts focus mostly on one's self
___	2-54 Non-explicit	=	Subtle, does not communicate explicitly, communicates by metaphor, et allegory, et example
___	2-55 Distant	=	Aloof, stands off from others, difficult to become friends with
___	2-56 Intellectually stimulating	=	Encourages others to think and use their minds; challenges beliefs, stereotypes and attitudes of others

This is the end of Section 2. Please continue on to Section 3.

Section 4 — Leader Behaviors (Part II)

Instructions

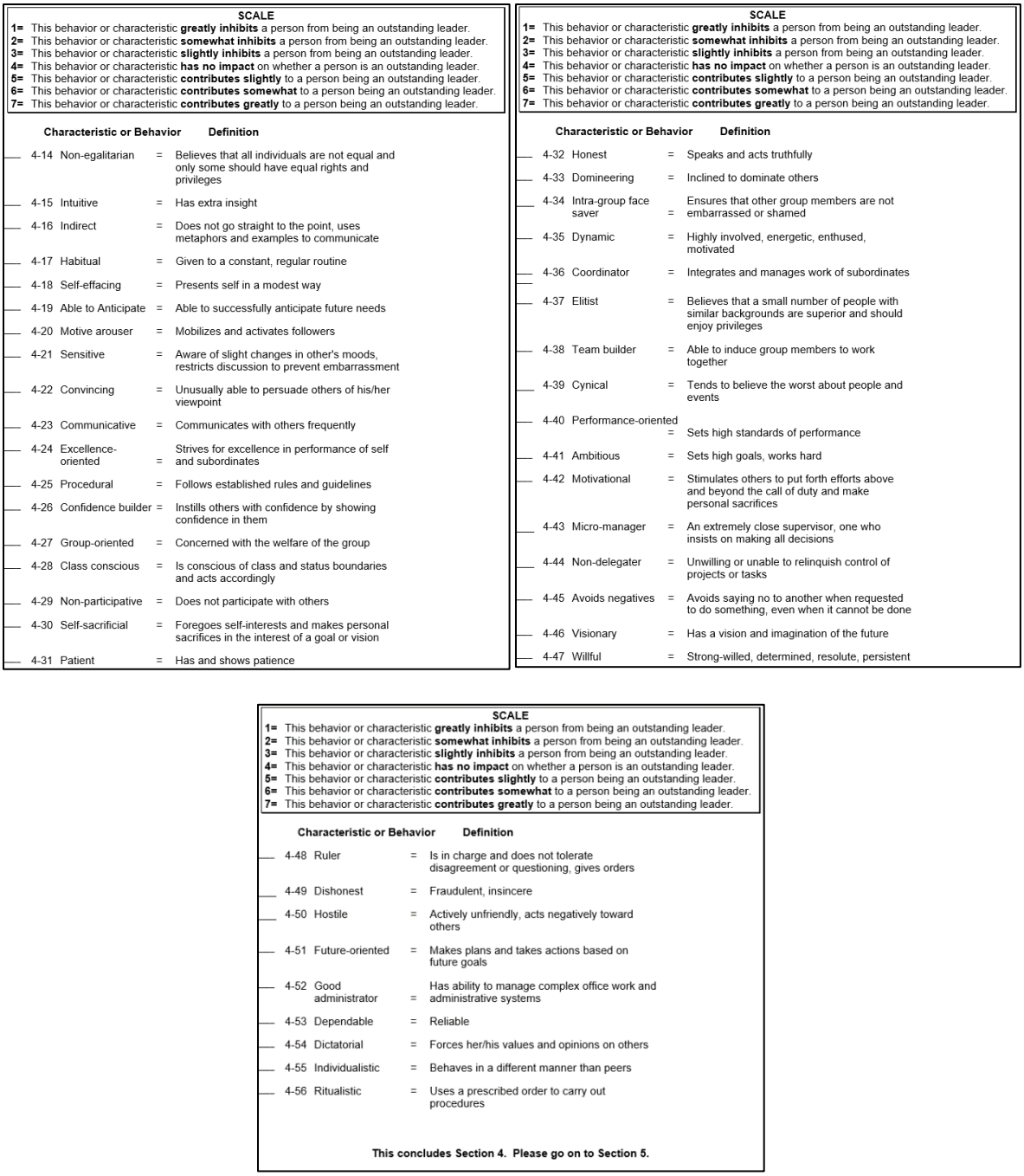
This section follows the same format as that of Section 2. You should again rate the leader behaviors and characteristics on the following pages. To do this, on the line next to each behavior or characteristic write the number from the scale below that best describes how important that behavior or characteristic is for a leader to be outstanding.

SCALE

1= This behavior or characteristic **greatly inhibits** a person from being an outstanding leader.
2= This behavior or characteristic **somewhat inhibits** a person from being an outstanding leader.
3= This behavior or characteristic **slightly inhibits** a person from being an outstanding leader.
4= This behavior or characteristic **has no impact** on whether a person is an outstanding leader.
5= This behavior or characteristic **contributes slightly** to a person being an outstanding leader.
6= This behavior or characteristic **contributes somewhat** to a person being an outstanding leader.
7= This behavior or characteristic **contributes greatly** to a person being an outstanding leader.

Section 4 questions begin here.

___	4-1 Cautious	=	Proceeds/performs with great care and does not take risks
___	4-2 Organized	=	Well organized, methodical, orderly
___	4-3 Cunning	=	Sly, deceitful, full of guile
___	4-4 Informed	=	Knowledgeable; aware of information.
___	4-5 Effective bargainer	=	Is able to negotiate effectively, able to make transactions with others on favorable terms
___	4-6 Egotistical	=	Conceited, convinced of own abilities
___	4-7 Non-cooperative	=	Unwilling to work jointly with others
___	4-8 Logical	=	Applies logic when thinking
___	4-9 Status-conscious	=	Aware of others' socially accepted status
___	4-10 Foresight	=	Anticipates possible future events
___	4-11 Plans ahead	=	Anticipates and prepares in advance
___	4-12 Normative	=	Behaves according to the norms of his or her group
___	4-13 Individually-oriented	=	Concerned with and places high value on preserving individual rather than group needs



SCALE

1= This behavior or characteristic **greatly inhibits** a person from being an outstanding leader.
2= This behavior or characteristic **somewhat inhibits** a person from being an outstanding leader.
3= This behavior or characteristic **slightly inhibits** a person from being an outstanding leader.
4= This behavior or characteristic **has no impact** on whether a person is an outstanding leader.
5= This behavior or characteristic **contributes slightly** to a person being an outstanding leader.
6= This behavior or characteristic **contributes somewhat** to a person being an outstanding leader.
7= This behavior or characteristic **contributes greatly** to a person being an outstanding leader.

	Characteristic or Behavior		Definition
___	4-14 Non-egalitarian	=	Believes that all individuals are not equal and only some should have equal rights and privileges
___	4-15 Intuitive	=	Has extra insight
___	4-16 Indirect	=	Does not go straight to the point, uses metaphors and examples to communicate
___	4-17 Habitual	=	Given to a constant, regular routine
___	4-18 Self-effacing	=	Presents self in a modest way
___	4-19 Able to Anticipate	=	Able to successfully anticipate future needs
___	4-20 Motive arouser	=	Mobilizes and activates followers
___	4-21 Sensitive	=	Aware of slight changes in other's moods, restricts discussion to prevent embarrassment
___	4-22 Convincing	=	Unusually able to persuade others of his/her viewpoint
___	4-23 Communicative	=	Communicates with others frequently
___	4-24 Excellence-oriented	=	Strives for excellence in performance of self and subordinates
___	4-25 Procedural	=	Follows established rules and guidelines
___	4-26 Confidence builder	=	Instills others with confidence by showing confidence in them
___	4-27 Group-oriented	=	Concerned with the welfare of the group
___	4-28 Class conscious	=	Is conscious of class and status boundaries and acts accordingly
___	4-29 Non-participative	=	Does not participate with others
___	4-30 Self-sacrificial	=	Foregoes self-interests and makes personal sacrifices in the interest of a goal or vision
___	4-31 Patient	=	Has and shows patience

SCALE

1= This behavior or characteristic **greatly inhibits** a person from being an outstanding leader.
2= This behavior or characteristic **somewhat inhibits** a person from being an outstanding leader.
3= This behavior or characteristic **slightly inhibits** a person from being an outstanding leader.
4= This behavior or characteristic **has no impact** on whether a person is an outstanding leader.
5= This behavior or characteristic **contributes slightly** to a person being an outstanding leader.
6= This behavior or characteristic **contributes somewhat** to a person being an outstanding leader.
7= This behavior or characteristic **contributes greatly** to a person being an outstanding leader.

	Characteristic or Behavior		Definition
___	4-32 Honest	=	Speaks and acts truthfully
___	4-33 Domineering	=	Inclined to dominate others
___	4-34 Intra-group face saver	=	Ensures that other group members are not embarrassed or shamed
___	4-35 Dynamic	=	Highly involved, energetic, enthused, motivated
___	4-36 Coordinator	=	Integrates and manages work of subordinates
___	4-37 Elitist	=	Believes that a small number of people with similar backgrounds are superior and should enjoy privileges
___	4-38 Team builder	=	Able to induce group members to work together
___	4-39 Cynical	=	Tends to believe the worst about people and events
___	4-40 Performance-oriented	=	Sets high standards of performance
___	4-41 Ambitious	=	Sets high goals, works hard
___	4-42 Motivational	=	Stimulates others to put forth efforts above and beyond the call of duty and make personal sacrifices
___	4-43 Micro-manager	=	An extremely close supervisor, one who insists on making all decisions
___	4-44 Non-delegater	=	Unwilling or unable to relinquish control of projects or tasks
___	4-45 Avoids negatives	=	Avoids saying no to another when requested to do something, even when it cannot be done
___	4-46 Visionary	=	Has a vision and imagination of the future
___	4-47 Willful	=	Strong-willed, determined, resolute, persistent

SCALE

1= This behavior or characteristic **greatly inhibits** a person from being an outstanding leader.
2= This behavior or characteristic **somewhat inhibits** a person from being an outstanding leader.
3= This behavior or characteristic **slightly inhibits** a person from being an outstanding leader.
4= This behavior or characteristic **has no impact** on whether a person is an outstanding leader.
5= This behavior or characteristic **contributes slightly** to a person being an outstanding leader.
6= This behavior or characteristic **contributes somewhat** to a person being an outstanding leader.
7= This behavior or characteristic **contributes greatly** to a person being an outstanding leader.

	Characteristic or Behavior		Definition
___	4-48 Ruler	=	Is in charge and does not tolerate disagreement or questioning, gives orders
___	4-49 Dishonest	=	Fraudulent, insincere
___	4-50 Hostile	=	Actively unfriendly, acts negatively toward others
___	4-51 Future-oriented	=	Makes plans and takes actions based on future goals
___	4-52 Good administrator	=	Has ability to manage complex office work and administrative systems
___	4-53 Dependable	=	Reliable
___	4-54 Dictatorial	=	Forces her/his values and opinions on others
___	4-55 Individualistic	=	Behaves in a different manner than peers
___	4-56 Ritualistic	=	Uses a prescribed order to carry out procedures

This concludes Section 4. Please go on to Section 5.

Figure A1. GLOBE leadership scales composed of 112 leadership scale items. Reprinted from "GLOBE Project: GLOBE Research Survey Form Beta," by the GLOBE foundation, 2006 (http://globeproject.com/data/GLOBE-Phase-2-Alpha-Questionnaire-2006.pdf). Copyright 2006 by the GLOBE Foundation. Reprinted with permission.

APPENDIX B

GLOBE Theoretical Model

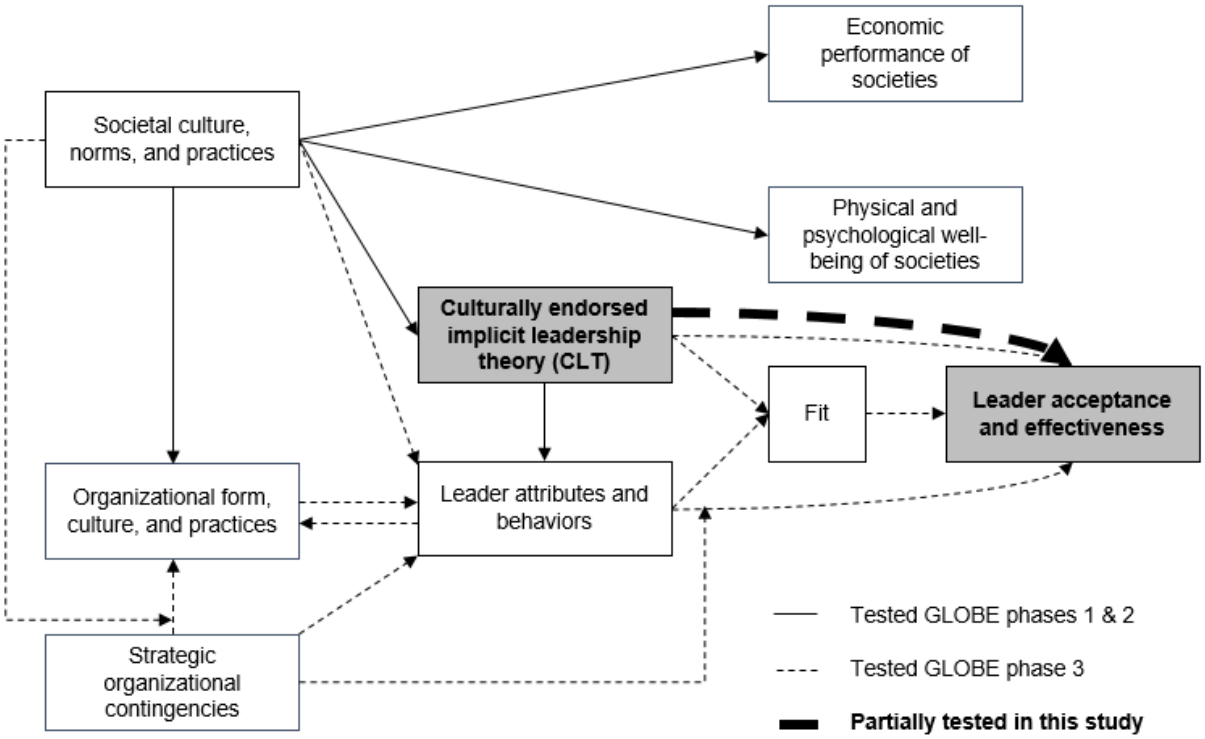


Figure B1. GLOBE theoretical model relevant to the present study. This study tests one aspect of culturally endorsed implicit leadership theory. Lord and Maher (1991) distinguished between an individual's ability to recognize leadership based on perception, versus an individual's cognitive processes. One can view certain traits in others and perceive those traits as leadership. Second, one will perceive whether another is a leader and judge the acts of leadership as effective or ineffective, based the internal knowledge structure or schema of the one judging. This study tests the second, in part. Adapted from *Strategic Leadership across Cultures: The GLOBE Study of CEO Leadership Behavior and Effectiveness in 24 Countries*, by R. J. House, P. W. Dofrman, M. Javidan, P. J. Hanges, & M. F. Sully de Luque, 2014, Los Angeles, CA: Sage Publications. Copyright 2014 by the Sage Corporation. Adapted with permission.

APPENDIX C

(GLOBE Leadership Scales Mapping

Table C1

GLOBE Leadership Scales Mapping

Six Global CLTs	21 Primary CLTs	112 Attributes	GLOBE Findings
Autonomous	Autonomous	Autonomous	Culturally Contingent
		Independent	Culturally Contingent
		Individualistic	Culturally Contingent
		Unique	Culturally Contingent
Charismatic/Value-based	Charisma 1: Visionary	Able to anticipate	
		Anticipatory	Culturally Contingent
		Foresight	Universally Positive
		Future-oriented	
		Inspirational	
		Intellectually stimulating	
		Plans ahead	Universally Positive
		Prepared	
		Visionary	
	Charisma 2: Inspirational	Confidence builder	Universally Positive
		Dynamic	Universally Positive
		Encouraging	Universally Positive
		Enthusiastic	Culturally Contingent
		Morale booster	
		Motivational	Universally Positive
		Motive arouser	Universally Positive
		Positive	Universally Positive
	Charisma 3: Self-sacrifice	Convincing	
		Risk taker	Culturally Contingent
		Self-sacrificial	Culturally Contingent
	Decisive	Decisive	Universally Positive
		Intuitive	Culturally Contingent
		Logical	Culturally Contingent
		Willful	Culturally Contingent
	Integrity	Honest	Universally Positive
		Just	Universally Positive
		Sincere	Culturally Contingent
		Trustworthy	Universally Positive
	Performance-oriented	Excellence-oriented	Universally Positive
		Improvement-oriented	
		Performance-oriented	
Humane-oriented	Humane-oriented	Compassionate	Culturally Contingent
		Generous	
	Modest	Calm	
		Modest	
		Patient	
		Self-effacing	Culturally Contingent
Participative	Autocratic (Reverse Scored)	Autocratic	
		Bossy	
		Dictatorial	Universally Negative
		Domineering	Culturally Contingent
		Elitist	Culturally Contingent
		Ruler	Culturally Contingent
	Non-participative (Reverse-scored)	Individually oriented	
		Micromanager	Culturally Contingent
		Non-delegator	
		Non-egalitarian	

(continued)

Six Global CLTs	21 Primary CLTs	112 Attributes	GLOBE Findings
Self-protective	Internally Competitive (formerly Conflict Inducer)	Intra-group competitor	Culturally Contingent
		Normative	
		Secretive	
	Face-saver	Avoids negatives	
		Evasive	Culturally Contingent
		Indirect	Culturally Contingent
	Bureaucratic (formerly Procedural)	Cautious	Culturally Contingent
		Formal	Culturally Contingent
		Habitual	Culturally Contingent
		Procedural	Culturally Contingent
		Ritualistic	
	Self-centered	Asocial	Universally Negative
		Loner	Universally Negative
		Non-participative	
		Self-interested	
	Status-conscious	Class conscious	Culturally Contingent
		Status-conscious	Culturally Contingent
Team-oriented	Administratively Competent	Administratively skilled	Universally Positive
		Good administrator	
		Orderly	Culturally Contingent
		Organized	
	Diplomatic	Diplomatic	
		Effective bargainer	Universally Positive
		Intra-group conflict avoider	Culturally Contingent
		Win/win problem-solver	Universally Positive
		Worldly	Culturally Contingent
	Malevolent (Reverse scored)	Cynical	
		Dependable (Reverse scored)	Universal Positive
		Dishonest	
		Egotistical	
		Hostile	
		Intelligent (Reverse scored)	Universally Positive
		Irritable	Universally Negative
		Non-cooperative	Universally Negative
		Vindictive	
	Team 1: Collaborative Team Orientation	Collaborative	
		Consultative	
		Fraternal	
		Group-oriented	
		Loyal	
		Mediator	
	Team 2: Team Integrator	Clear	
		Communicative	Universally Positive
		Coordinator	Universally Positive
		Informed	Universally Positive
		Integrator	
		Subdued	Culturally Contingent
		Team-builder	
Unassigned	Factors did not load	Ambitious	Culturally Contingent
		Arrogant	
		Cunning	Culturally Contingent
		Distant	
		Egocentric	Universally Negative
		Intra-group face-saver	
		Non-explicit	Universally Negative
		Provocateur	Culturally Contingent
		Risk averse	
		Ruthless	Universally Negative
		Sensitive	Culturally Contingent
		Tender	
		Tyrannical	

(continued)

Note: Depicts six global CLTs, 21 primary CLTs, and 112 leadership attributes, along with whether attributes are universally positive, universally negative, or culturally contingent regarding acceptance. Adapted from *Strategic Leadership across Cultures: The GLOBE Study of CEO Leadership Behavior and Effectiveness in 24 Countries*, by R. J. House, P. W. Dofrman, M. Javidan, P. J. Hanges, & M. F. Sully de Luque, 2014, Los Angeles, CA: Sage Publications.

APPENDIX D

Country Cluster Aggregation for List of Nations

Table D1

Countries Corresponding to Popular Country Clusters

Country Cluster ID	Country Clusters	
	GLOBE Study (2004, 2007)	Ronen and Shenkar (2013)
1	Middle East Egypt Kuwait Morocco Qatar Turkey	Arab Egypt Kuwait Morocco Qatar Bahrain Saudi Arabia Oman UAE
2	Confucian Asia China Hong Kong Japan Singapore South Korea Taiwan	Confucian Asia China Hong Kong *Japan* Singapore South Korea Taiwan Nepal
3	Southern Asia India Indonesia Iran Malaysia Philippines Thailand	Far East *India* Indonesia Iran Malaysia Philippines Thailand Azerbaijan Bangladesh Ethiopia Jamaica Zimbabwe Pakistan
4	Latin America Argentina Bolivia Brazil Columbia Costa Rica Ecuador El Salvador Guatemala Mexico	Latin America Argentina Bolivia *Brazil* Columbia Costa Rica Ecuador El Salvador Guatemala Mexico

(continued)

Country Cluster ID	Country Clusters	
	GLOBE Study (2004, 2007)	Ronen and Shenkar (2013)
	Peru	Peru
	Venezuela	Venezuela
		Dominican Republic
		Puerto Rico
		Panama
		Chile
		Uruguay
5	Nordic Europe	Nordic
	Denmark	Denmark
	Finland	Finland
	Sweden	Sweden
		Netherlands
		Iceland
		Norway
6	Anglo	Anglo
	Australia	Australia
	Canada	Canada
	England	U.K.
	Ireland	Ireland
	New Zealand	New Zealand
	South Africa (White)	South Africa (White)
	United States	United States
7	South Pacific	Unnamed
	Fiji	
	Solomon Islands	
	Tonga	
	Vanuatu	
		Polynesia
		Caribbean
8	Germanic Europe	Germanic
	Austria	Austria
	Germany	Germany
	Netherlands	
	Switzerland	Switzerland
9	Latin Europe	Latin Europe
	France	France
	Israel	*Israel*
	Italy	Italy
	Portugal	Portugal
	Spain	Spain
	Switzerland (French)	Switzerland (French)
		Belgium
10	Sub-Saharan Africa	African
	Namibia	Namibia
	Nigeria	Nigeria
	South Africa (Black)	South Africa (Black)
	Zimbabwe	
		Ghana
		South Africa
		Zambia
11	Eastern Europe	East Europe
	Albania	

(continued)

Country Cluster ID	Country Clusters	
	GLOBE Study (2004, 2007)	Ronen and Shenkar (2013)
	Azerbaijan	
	Estonia	Estonia
	Georgia	Georgia
	Greece	
	Hungary	
	Kazakhstan	Kazakhstan
	Poland	Poland
	Romania	Romania
	Russia	Russia
	Slovenia	Slovenia
		Latvia
		Macedonia
		Bosnia
		Lithuania
		Croatia
		Moldova
		Armenia
		Slovakia
		Ukraine
		Belarus
		Bulgaria
		Cyprus
		Czech Republic

Note. The list of countries from which study participants will select national origin is composed of countries presented in the GLOBE Study country clusters supplemented by bolded countries presented in the Ronen and Shenkar country clusters. Adapted from *Strategic Leadership across Cultures: The GLOBE Study of CEO Leadership Behavior and Effectiveness in 24 Countries*, by R. J. House, P. W. Dofrman, M. Javidan, P. J. Hanges, & M. F. Sully de Luque, 2014, Los Angeles, CA: Sage Publications. Copyright 2014 by the Sage Corporation. Adapted with permission. Adapted from "Mapping world cultures: Cluster formation, sources and implications," by S. Ronen & O. Shenkar, 2013, *Journal of International Business Studies, 44*(9), 867-897. Copyright 2013 by the Academy of International business. Adapted with permission.

APPENDIX E

GLOBE Country Clusters as of Phase 3

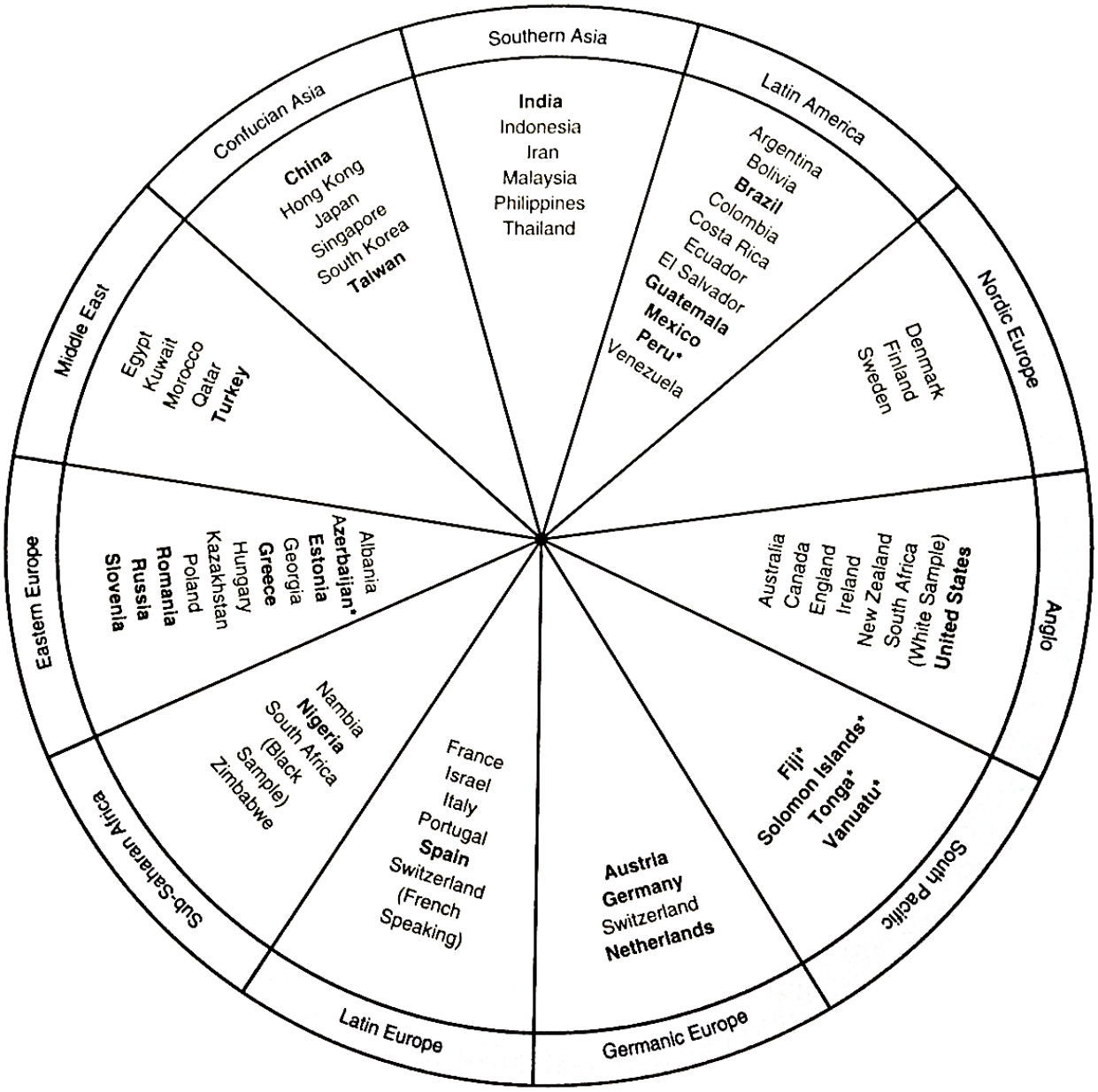


Figure E1. GLOBE country clusters as of phase 3. Countries range in similarity and dissimilarity based on cluster proximity. Clusters that are opposite one another are least similar. Countries in bold were added in phase three. Countries with asterisk not included in phases one and two. Adapted from *Strategic Leadership across Cultures: The GLOBE Study of CEO Leadership Behavior and Effectiveness in 24 Countries*, by R. J. House, P. W. Dofrman, M. Javidan, P. J. Hanges, & M. F. Sully de Luque, 2014, Los Angeles, CA: Sage Publications. Copyright 2014 by the Sage Corporation. Adapted with permission.

APPENDIX F

STEM Occupations Eligible for the Study

Life and physical science, engineering, mathematics, and information technology occupations		Social science occupations	
Code	**Occupation**	**Code**	**Occupation**
15-1111	Computer and Information Research Scientists	19-3011	Economists
15-1121	Computer Systems Analysts	19-3022	Survey Researchers
15-1122	Information Security Analysts	19-3031	Clinical, Counseling, and School Psychologists
15-1132	Software Developers, Applications	19-3032	Industrial-Organizational Psychologists
15-1133	Software Developers, Systems Software	19-3039	Psychologists, All Other
15-1134	Web Developers	19-3041	Sociologists
15-1141	Database Administrators	19-3051	Urban and Regional Planners
15-1142	Network and Computer Systems Administrators	19-3091	Anthropologists and Archeologists
15-1143	Computer Network Architects	19-3092	Geographers
15-1199	Computer Occupations, All Other	19-3094	Political Scientists
15-2011	Actuaries	19-3099	Social Scientists and Related Workers, All Other
15-2021	Mathematicians	--	--
15-2031	Operations Research Analysts	--	--
15-2041	Statisticians	--	--
15-2099	Mathematical Science Occupations, All Other	--	--
17-2011	Aerospace Engineers	--	--
17-2021	Agricultural Engineers	--	--
17-2031	Biomedical Engineers	--	--
17-2041	Chemical Engineers	--	--
17-2051	Civil Engineers	--	--
17-2061	Computer Hardware Engineers	--	--
17-2071	Electrical Engineers	--	--
17-2072	Electronics Engineers, Except Computer	--	--
17-2081	Environmental Engineers	--	--
17-2111	Health and Safety Engineers, Except Mining Safety	--	--
17-2112	Industrial Engineers	--	--
17-2121	Marine Engineers and Naval Architects	--	--
17-2131	Materials Engineers	--	--
17-2141	Mechanical Engineers	--	--
17-2151	Mining and Geological Engineers, Incl Mining Safety	--	--
17-2161	Nuclear Engineers	--	--
17-2171	Petroleum Engineers	--	--
17-2199	Engineers, All Other	--	--
19-1011	Animal Scientists	--	--
19-1012	Food Scientists and Technologists	--	--
19-1013	Soil and Plant Scientists	--	--
19-1021	Biochemists and Biophysicists	--	--
19-1022	Microbiologists	--	--
19-1023	Zoologists and Wildlife Biologists	--	--
19-1029	Biological Scientists, All Other	--	--
19-1031	Conservation Scientists	--	--
19-1032	Foresters	--	--
19-1041	Epidemiologists	--	--
19-1042	Medical Scientists, Except Epidemiologists	--	--
19-1099	Life Scientists, All Other	--	--
19-2011	Astronomers	--	--
19-2012	Physicists	--	--
19-2021	Atmospheric and Space Scientists	--	--
19-2031	Chemists	--	--
19-2032	Materials Scientists	--	--
19-2041	Environmental Scientists and Specialists, Incl Health	--	--
19-2042	Geoscientists, Except Hydrologists/Geographers	--	--
19-2043	Hydrologists	--	--
19-2099	Physical Scientists, All Other	--	--

APPENDIX G

Related technologist, Technician and Management Occupations

Life and physical science, engineering, mathematics, and information technologist and technician occupations		Social science technologist and technician occupations	
Code	**Occupation**	**Code**	**Occupation**
15-1131	Computer Programmers	19-4061	Social Science Research Assistants
15-1151	Computer User Support Specialists	--	--
15-1152	Computer Network Support Specialists	--	--
15-2091	Mathematical Technicians	--	--
17-1021	Cartographers and Photogrammetrists	--	--
17-1022	Surveyors	--	--
17-3012	Electrical and Electronics Drafters	--	--
17-3013	Mechanical Drafters	--	--
17-3019	Drafters, All Other	--	--
17-3021	Aerospace Engineering and Operations Technicians	--	--
17-3022	Civil Engineering Technicians	--	--
17-3023	Electrical and Electronics Engineering Technicians	--	--
17-3024	Electro-Mechanical Technicians	--	--
17-3025	Environmental Engineering Technicians	--	--
17-3026	Industrial Engineering Technicians	--	--
17-3027	Mechanical Engineering Technicians	--	--
17-3029	Engineering Technicians, Except Drafters, All Other	--	--
17-3031	Surveying and Mapping Technicians	--	--
19-4011	Agricultural and Food Science Technicians	--	--
19-4021	Biological Technicians	--	--
19-4031	Chemical Technicians	--	--
19-4041	Geological and Petroleum Technicians	--	--
19-4051	Nuclear Technicians	--	--
19-4091	Environ. Science and Protection Techs, Incl Health	--	--
19-4092	Forensic Science Technicians	--	--
19-4093	Forest and Conservation Technicians	--	--
19-4099*	Life, Physical, and Social Science Technicians, All Other	19-4099*	Life, Physical, and Social Science Technicians, All Other
11-1031	Computer and Information Systems Managers	--	--
11-9041*	Architectural and Engineering Managers	--	--
11-9121	Natural Sciences Managers	--	--

APPENDIX H

STEM Related Architecture and Health Occupations

Life and physical science, engineering, mathematics, and information technologist and technician occupations		Social science technologist and technician occupations	
Code	**Occupation**	**Code**	**Occupation**
15-1131	Computer Programmers	19-4061	Social Science Research Assistants
15-1151	Computer User Support Specialists	--	--
15-1152	Computer Network Support Specialists	--	--
15-2091	Mathematical Technicians	--	--
17-1021	Cartographers and Photogrammetrists	--	--
17-1022	Surveyors	--	--
17-3012	Electrical and Electronics Drafters	--	--
17-3013	Mechanical Drafters	--	--
17-3019	Drafters, All Other	--	--
17-3021	Aerospace Engineering and Operations Technicians	--	--
17-3022	Civil Engineering Technicians	--	--
17-3023	Electrical and Electronics Engineering Technicians	--	--
17-3024	Electro-Mechanical Technicians	--	--
17-3025	Environmental Engineering Technicians	--	--
17-3026	Industrial Engineering Technicians	--	--
17-3027	Mechanical Engineering Technicians	--	--
17-3029	Engineering Technicians, Except Drafters, All Other	--	--
17-3031	Surveying and Mapping Technicians	--	--
19-4011	Agricultural and Food Science Technicians	--	--
19-4021	Biological Technicians	--	--
19-4031	Chemical Technicians	--	--
19-4041	Geological and Petroleum Technicians	--	--
19-4051	Nuclear Technicians	--	--
19-4091	Environ. Science and Protection Techs, Incl Health	--	--
19-4092	Forensic Science Technicians	--	--
19-4093	Forest and Conservation Technicians	--	--
19-4099*	Life, Physical, and Social Science Technicians, All Other	19-4099*	Life, Physical, and Social Science Technicians, All Other
11-1031	Computer and Information Systems Managers	--	--
11-9041*	Architectural and Engineering Managers	--	--
11-9121	Natural Sciences Managers	--	--

APPENDIX I

GLOBE Permissions

On Thu, Mar 19, 2015 at 10:43 AM, Natasha Fox wrote:

> Dear Deb,
>
> Greetings—I am Natasha Fox, research assistant for Professor Ali Dastmalchian, CEO of the GLOBE project. It is my pleasure to respond to your inquiries on Professor Dastmalchian's behalf:
>
> 1. You can certainly use CLT measures (the 21 dimensions or the six 2nd order factors) for STEM and compare their average scores with those of GLOBE in general and GLOBE's scores for USA, and also with the "telecommunication" industry scores for USA –which is the closest industry to STEM, and draw implications.
> 2. You could also at later stage use the GLOBE's CEO study measure of leader behaviour and achieve your goals., To obtain information about the GLOBE's CEO study, you need to obtain a copy of the 2014 book: House, R.J., Dorfman, P., Javidan, M., Hanges, P., and Sully de Luque, M.F. (2014). Strategic Leadership Across Cultures: the GLOBE Study of CEO leadership Behavior and Effectiveness in 24 Countries. Thousand Oaks, CA: Sage.
> 3. Lastly please note that you are free to disclose to individual study participants the degree to which they favoured particular Global CLT scales, however please be advised that due to privacy reasons you may want to use caution in order to avoid sharing the results of your participants to one another.
>
> I hope this information answers your questions, but if you need further clarification please don't hesitate to contact me again.
>
> Thank you and best wishes,
>
> Natasha Fox
> Research Assistant, GLOBE Project
> University of Victoria

From: Natasha Fox
Sent: Monday, March 23, 2015 9:34 AM
To: Deb Doel-Hammond
Subject: Re: GLOBE Study Leadership Scales for Use in U.S. STEM

Dear Deb,

As long as you ask the nationality of the respondents in the survey, you then will be able to split the sample according to nationalities and compare scores. But we then get into other areas such as "how long they have lived in US"? Where did they do their education? Etc. as variables that may affect the interpretation of the findings. In other words, if you want to do this, we would recommend doing some thinking about the design of the data collection process and conceptual frame.

Hope this helps!

Natasha

From: Deb Doel-Hammond
Date: Thursday, March 19, 2015 at 7:47 PM
Subject: Re: FW: GLOBE Study Leadership Scales for Use in U.S. STEM

Natasha,

Thank you so much. Another question: What do you think of administering the survey in a single population with high national diversity (foreign born workers) working in a U.S. company, to contrast views of leadership? Using the scales in this way greatly interests me.

Sincere thanks,

Deb

We welcome researchers to use the GLOBE scales. Our simple request is that you cite Chapter 8 and the 2004 GLOBE book in your publications. We also request that you and your research team carefully consider the levels of analysis issue when designing your research. Finally, the GLOBE team would appreciate receiving reports and/or publication copies of your research findings. Please send these to Mansour Javidan at javidanm@t-bird.edu.

APPENDIX J

Women in U.S. STEM College Majors and Selected Occupations

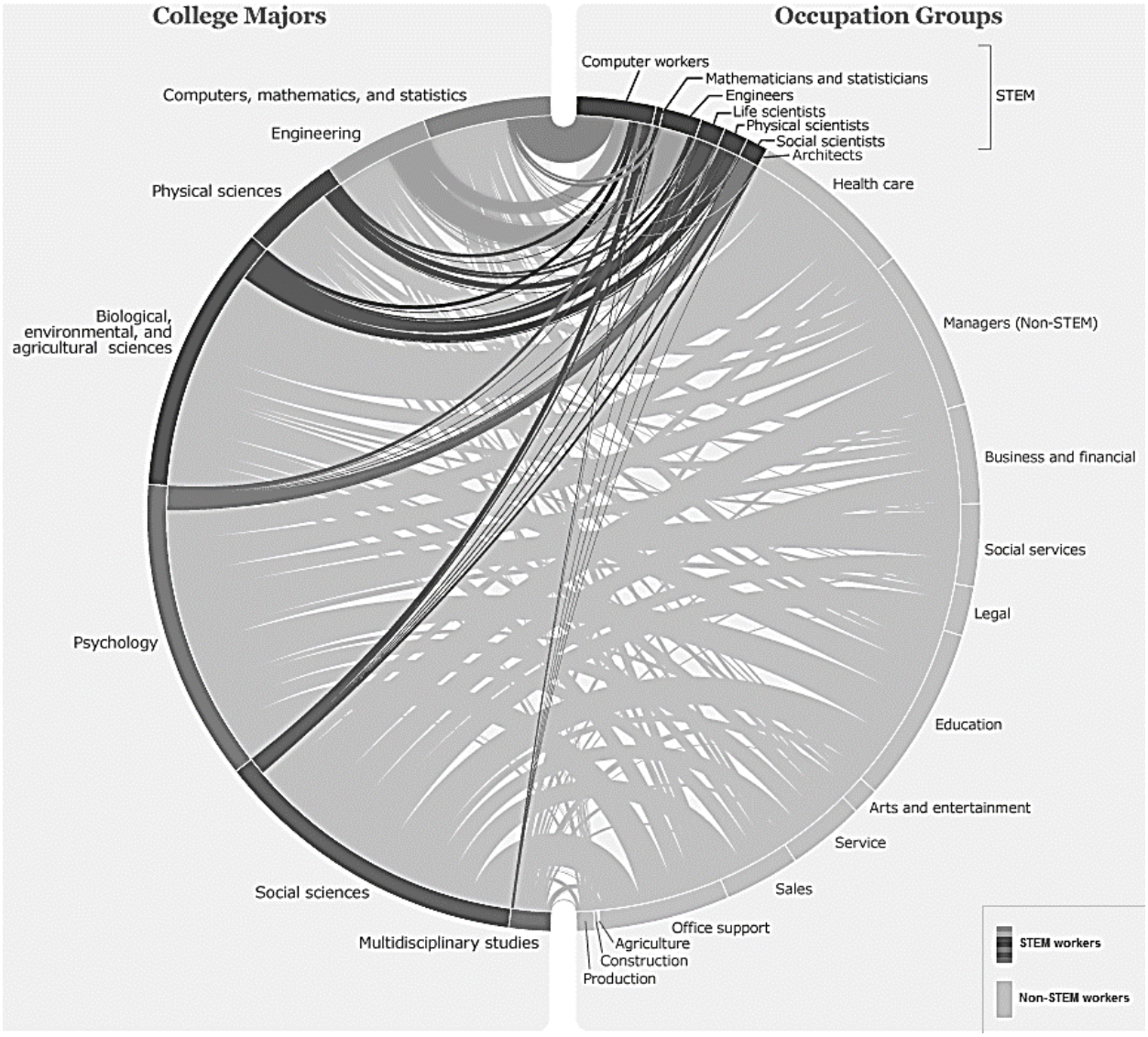


Figure J1. Women in STEM college majors according to the U.S. Census Bureau, 2012 American Community Survey. Darker grays depict women with STEM college majors who work in STEM occupation groups. The light gray background depicts women with STEM college majors who work in non-STEM occupations. Adapted from "Where do college graduates work? A Special Focus on Science, Technology, Engineering and Math" 2014, U.S. Census Bureau. No copyright per Title 17 U.S.C., Section 105

APPENDIX K

All U.S. STEM College Majors and Selected Occupations

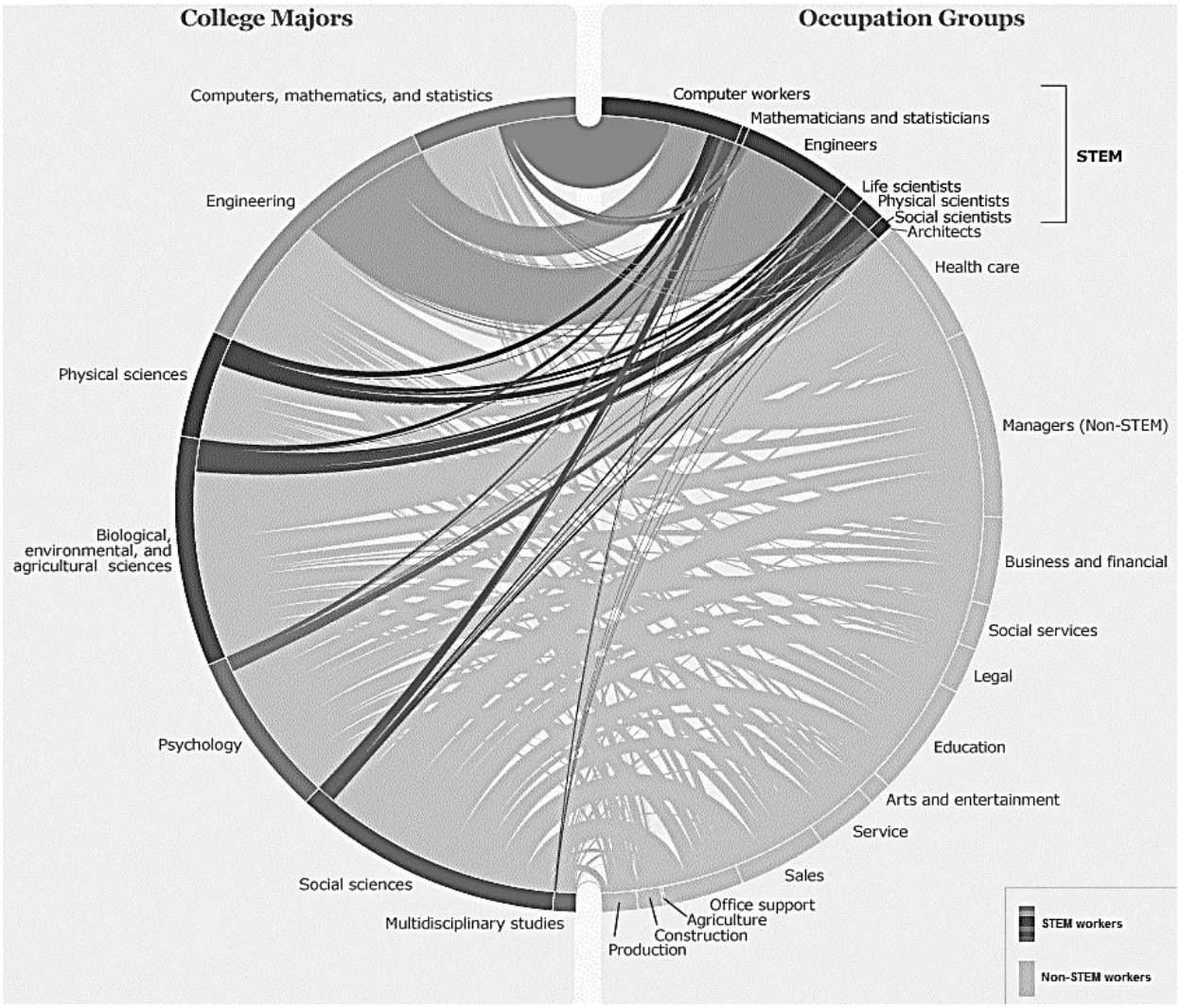


Figure K1. All STEM college majors according to the U.S. Census Bureau, 2012 American Community Survey. Dark gray depicts persons with STEM college majors who work in STEM occupation groups. The light gray background depicts persons with STEM college majors who work in non-STEM occupations. Adapted from "Where do college graduates work? A Special Focus on Science, Technology, Engineering and Math" 2014, U.S. Census Bureau. No copyright per Title 17 U.S.C., Section 105.

APPENDIX L

STEM Occupations Eligible for the Study

Table L1

STEM Occupations Eligible for the Study

Life and physical science, engineering, mathematics, and information technology occupations		Social science occupations	
Code	**Occupation**	**Code**	**Occupation**
15-1111	Computer and Information Research Scientists	19-3011	Economists
15-1121	Computer Systems Analysts	19-3022	Survey Researchers
15-1122	Information Security Analysts	19-3031	Clinical, Counseling, and School Psychologists
15-1132	Software Developers, Applications	19-3032	Industrial-Organizational Psychologists
15-1133	Software Developers, Systems Software	19-3039	Psychologists, All Other
15-1134	Web Developers	19-3041	Sociologists
15-1141	Database Administrators	19-3051	Urban and Regional Planners
15-1142	Network and Computer Systems Administrators	19-3091	Anthropologists and Archeologists
15-1143	Computer Network Architects	19-3092	Geographers
15-1199	Computer Occupations, All Other	19-3094	Political Scientists
15-2011	Actuaries	19-3099	Social Scientists and Related Workers, All Other
15-2021	Mathematicians	--	--
15-2031	Operations Research Analysts	--	--
15-2041	Statisticians	--	--
15-2099	Mathematical Science Occupations, All Other	--	--
17-2011	Aerospace Engineers	--	--
17-2021	Agricultural Engineers	--	--
17-2031	Biomedical Engineers	--	--
17-2041	Chemical Engineers	--	--
17-2051	Civil Engineers	--	--
17-2061	Computer Hardware Engineers	--	--
17-2071	Electrical Engineers	--	--
17-2072	Electronics Engineers, Except Computer	--	--
17-2081	Environmental Engineers	--	--
17-2111	Health and Safety Engineers, Except Mining Safety	--	--
17-2112	Industrial Engineers	--	--
17-2121	Marine Engineers and Naval Architects	--	--
17-2131	Materials Engineers	--	--
17-2141	Mechanical Engineers	--	--
17-2151	Mining and Geological Engineers, Incl Mining Safety	--	--
17-2161	Nuclear Engineers	--	--
17-2171	Petroleum Engineers	--	--
17-2199	Engineers, All Other	--	--
19-1011	Animal Scientists	--	--
19-1012	Food Scientists and Technologists	--	--
19-1013	Soil and Plant Scientists	--	--
19-1021	Biochemists and Biophysicists	--	--
19-1022	Microbiologists	--	--
19-1023	Zoologists and Wildlife Biologists	--	--
19-1029	Biological Scientists, All Other	--	--
19-1031	Conservation Scientists	--	--
19-1032	Foresters	--	--
19-1041	Epidemiologists	--	--
19-1042	Medical Scientists, Except Epidemiologists	--	--
19-1099	Life Scientists, All Other	--	--
19-2011	Astronomers	--	--
19-2012	Physicists	--	--
19-2021	Atmospheric and Space Scientists	--	--
19-2031	Chemists	--	--
19-2032	Materials Scientists	--	--
19-2041	Environmental Scientists and Specialists, Incl Health	--	--
19-2042	Geoscientists, Except Hydrologists/Geographers	--	--
19-2043	Hydrologists	--	--
19-2099	Physical Scientists, All Other	--	--

APPENDIX M

STEM Related Technologist, Technician and Management Occupations

Table M1

STEM Related Occupations Eligible for Study

Life and physical science, engineering, mathematics, and information technologist and technician occupations		Social science technologist and technician occupations	
Code	**Occupation**	**Code**	**Occupation**
15-1131	Computer Programmers	19-4061	Social Science Research Assistants
15-1151	Computer User Support Specialists	--	--
15-1152	Computer Network Support Specialists	--	--
15-2091	Mathematical Technicians	--	--
17-1021	Cartographers and Photogrammetrists	--	--
17-1022	Surveyors	--	--
17-3012	Electrical and Electronics Drafters	--	--
17-3013	Mechanical Drafters	--	--
17-3019	Drafters, All Other	--	--
17-3021	Aerospace Engineering and Operations Technicians	--	--
17-3022	Civil Engineering Technicians	--	--
17-3023	Electrical and Electronics Engineering Technicians	--	--
17-3024	Electro-Mechanical Technicians	--	--
17-3025	Environmental Engineering Technicians	--	--
17-3026	Industrial Engineering Technicians	--	--
17-3027	Mechanical Engineering Technicians	--	--
17-3029	Engineering Technicians, Except Drafters, All Other	--	--
17-3031	Surveying and Mapping Technicians	--	--
19-4011	Agricultural and Food Science Technicians	--	--
19-4021	Biological Technicians	--	--
19-4031	Chemical Technicians	--	--
19-4041	Geological and Petroleum Technicians	--	--
19-4051	Nuclear Technicians	--	--
19-4091	Environ. Science and Protection Techs, Incl Health	--	--
19-4092	Forensic Science Technicians	--	--
19-4093	Forest and Conservation Technicians	--	--
19-4099*	Life, Physical, and Social Science Technicians, All Other	19-4099*	Life, Physical, and Social Science Technicians, All Other
11-1031	Computer and Information Systems Managers	--	--
11-9041*	Architectural and Engineering Managers	--	--
11-9121	Natural Sciences Managers	--	--

APPENDIX N

STEM Related Architecture and Health Occupations

Table N1

STEM Related Occupations Not Eligible for the Study

Architecture occupations		Architecture technologist and technician occupations		Health occupations		Health technologist and technician occupations	
Code	**Occupation**	**Code**	**Occupation**	**Code**	**Occupation**	**Code**	**Occupation**
17-1011	Architects, Except Landscape and Naval	17-3011*	Architectural and Civil Drafters	29-1011	Chiropractors	29-2011	Medical and Clinical Laboratory Technologists
17-1012	Landscape Architects	--	--	29-1021	Dentists, General	29-2012	Medical and Clinical Laboratory Technicians
--	--	--	--	29-1022	Oral and Maxillofacial Surgeons	29-2021	Dental Hygienists
--	--	--	--	29-1023	Orthodontists	29-2031	Cardiovascular Technologists and Technicians
--	--	--	--	29-1024	Prosthodontists	29-2032	Diagnostic Medical Sonographers
--	--	--	--	29-1029	Dentists, All Other Specialists	29-2033	Nuclear Medicine Technologists
--	--	--	--	29-1031	Dietitians and Nutritionists	29-2034	Radiologic Technologists
--	--	--	--	29-1041	Optometrists	29-2035	Magnetic Resonance Imaging Technologists
--	--	--	--	29-1051	Pharmacists	29-2041	Emergency Medical Technicians and Paramedics
--	--	--	--	29-1061	Anesthesiologists	29-2051	Dietetic Technicians
--	--	--	--	29-1062	Family and General Practitioners	29-2052	Pharmacy Technicians
--	--	--	--	29-1063	Internists, General	29-2053	Psychiatric Technicians
--	--	--	--	29-1064	Obstetricians and Gynecologists	29-2054	Respiratory Therapy Technicians
--	--	--	--	29-1065	Pediatricians, General	29-2055	Surgical Technologists
--	--	--	--	29-1066	Psychiatrists	29-2056	Veterinary Technologists and Technicians
--	--	--	--	29-1067	Surgeons	29-2057	Ophthalmic Medical Technicians
--	--	--	--	29-1069	Physicians and Surgeons, All Other	29-2061	Licensed Practical and Licensed Vocational Nurses
--	--	--	--	29-1071	Physician Assistants	29-2071	Medical Records and Health Information Technicians
--	--	--	--	29-1081	Podiatrists	29-2081	Opticians, Dispensing
--	--	--	--	29-1122	Occupational Therapists	29-2091	Orthotists and Prosthetists
--	--	--	--	29-1123	Physical Therapists	29-2092	Hearing Aid Specialists
--	--	--	--	29-1124	Radiation Therapists	29-2099	Health Technologists and Technicians, All Other
--	--	--	--	29-1125	Recreational Therapists	29-9011	Occupational Health and Safety Specialists
--	--	--	--	29-1126	Respiratory Therapists	29-9012	Occupational Health and Safety Technicians
--	--	--	--	29-1127	Speech-Language Pathologists	29-9091	Athletic Trainers
--	--	--	--	29-1128	Exercise Physiologists	29-9092	Genetic Counselors
--	--	--	--	29-1129	Therapists, All Other	29-9099	Healthcare Practitioners and Technical Workers, All Other
--	--	--	--	29-1131	Veterinarians	--	--
--	--	--	--	29-1141	Registered Nurses	--	--
--	--	--	--	29-1151	Nurse Anesthetists	--	--
--	--	--	--	29-1161	Nurse Midwives	--	--
--	--	--	--	29-1171	Nurse Practitioners	--	--
--	--	--	--	29-1181	Audiologists	--	--
--	--	--	--	29-1199	Health Diagnosing and Treating Practitioners, All Other	--	--

APPENDIX O

Sample Recruitment Text - Primary Contact

Dear _,

This [email/letter/phone call] is an invitation to participate in research sponsored by Pepperdine University (www.pepperdine.edu). My name is Deb Doel-Hammond. I am a doctoral candidate in organizational leadership at Pepperdine University, Graduate School of Education and Psychology and the Senior Director of Human Resources at the Allen Institute (www.alleninstitute.org). I am conducting research on views of outstanding leadership among individuals working in science, technology, engineering, and mathematics (STEM) occupations within the United States (U.S.). This research is conducted under the direction of June Schmieder-Ramirez, Ph.D.

Your participation will help further understanding of leadership preferences among individuals who work in U.S. STEM occupations. The scope of your involvement is completion of a 20 to 30-minute electronic questionnaire that asks your views of certain leadership characteristics. Participation is anonymous. You will view your responses contrasted with responses from around the world. After viewing your results, you will have the option to participate in a drawing for a $500 Amazon gift certificate.

Please forward this communication to your colleagues who work in STEM occupations. [Optional sentence]. If you wish to offer your [members/employees] the opportunity to participate in this study, but you require your organization's approval, please contact me and I am happy to assist you.]

If you have questions, please contact me, Deb Doel-Hammond, at _.

If you are ready to participate in the study, follow this LINK.

Sincerely,

Deb Doel-Hammond
Doctoral Candidate, Pepperdine University
ddoelham@pepperdine.edu

APPENDIX P

Sample Recruitment Text for Secondary Party Introduction

Dear _,

This email is an invitation to participate in research sponsored by Pepperdine University (www.pepperdine.edu). I wish to introduce you to Deb Doel-Hammond. Ms. Doel-Hammond is a doctoral candidate in organizational leadership at Pepperdine University, Graduate School of Education and Psychology and the Senior Director of Human Resources at the Allen Institute (www.alleninstitute.org). Ms. Doel-Hammond is conducting research on views of outstanding leadership among individuals working in science, technology, engineering, and mathematics (STEM) occupations within the United States (U.S.). This research is conducted under the direction of June Schmieder-Ramirez, Ph.D.

Your participation will contribute to the understanding of leadership preferences among individuals working in U.S. STEM occupations. The scope of your involvement is completion a 20 to 30-minute electronic questionnaire that asks your views of certain leadership characteristics. Participation is anonymous. You will view your responses contrasted with responses from around the world. At the end of the questionnaire, you have the option to enroll in a drawing for a $500 Amazon gift certificate.

If you have questions, please contact me at _ or Deb Doel-Hammond at _.

If you are ready to participate in the study, follow this LINK.

Finally, please share this opportunity with your colleagues who work in STEM occupations.

Sincerely,

Name
Title
Contact Information

(Note. This letter will be provided to the sender as a sample communication. The content or length of this letter will be modified based upon the preferences of the sender.)

APPENDIX Q

Survey One – Information Sheet and Adapted GLOBE Leadership Scales

Part One: Study Information

VIEWS OF OUTSTANDING LEADERSHIP AMONG THE U.S. STEM WORKFORCE

You are invited to participate in a research study conducted by Deb Doel-Hammond, doctoral candidate, under the direction of June Schmieder-Ramirez, Ph.D., dissertation chair, at Pepperdine University. Your participation is voluntary and anonymous.

PURPOSE OF THE STUDY

The purpose of this voluntary study is to learn about perceptions of certain leader characteristics among individuals working in science, technology, engineering, and mathematics (STEM) occupations within the business and industry sector in the United States (U.S.).

PARTICIPANT INVOLVEMENT

If you agree to participate in this study, you will first be asked to consent to the terms of participation. Second, you will answer three screening questions (occupation, work sector, and work country). Third, you will answer five demographic questions (gender, age, national affiliation, years worked in the U.S. and workforce category). Fourth, you will view 112 characteristics and definitions associated with leaders. You will be asked to rate the degree to which each characteristic either inhibits or contributes to a person being an outstanding leader. Fifth, you will view a summary of your views of leadership compared to other views across the world. The estimated time to complete the study is 30 to 45 minutes.

PAYMENT/COMPENSATION FOR PARTICIPATION

After completing the study, you will have the opportunity to enter a drawing for a $500 Amazon gift certificate. If you elect to enter the drawing, you will be redirected to a survey where you will provide an email address. If you win, instructions for redeeming the $500 Amazon gift certificate will be sent to this email address.

PARTICIPATION AND WITHDRAWAL

Your participation is voluntary. You may withdraw your consent at any time and discontinue participation without penalty, by exiting the survey.

ALTERNATIVES TO FULL PARTICIPATION

The alternative to participation in the study is not participating or completing only the items you choose to complete.

CONFIDENTIALITY

I will keep your records for this study anonymous to the extent permitted by law. However, if I am required to do so by law, I may be required to disclose information collected about you. Examples of the types of issues that would require me to break confidentiality are if you tell me about instances illegal conduct. Pepperdine's University's Human Subjects Protection Program (HSPP) may also access the data collected. The HSPP occasionally reviews and monitors research studies to protect the rights and welfare of research subjects. The data will be stored on a password protected computer in the principal investigators place of residence. The data will be stored for a minimum of three years.

INVESTIGATOR'S CONTACT INFORMATION

The investigator is willing to answer any inquiries concerning the research herein described. Contact Dr. June Schmieder-Ramirez at june.ramirez@pepperdine.edu with questions or concerns about this research.

RIGHTS OF RESEARCH PARTICIPANT – IRB CONTACT INFORMATION

If you have questions, concerns or complaints about your rights as a research participant or research in general please contact Dr. Judy Ho, Chairperson of the Graduate & Professional Schools Institutional Review Board at Pepperdine University 6100 Center Drive Suite 500, Los Angeles, CA 90045, 310-568-5753 or gpsirb@pepperdine.edu.

If you would like documentation of your participation in this research you may print a copy of this form.

By proceeding to the study, you acknowledge you have read this study information. You also understand that you may end your participation at end time, for any reason without penalty. You confirm you are 18 years or older.

Do you consent to the above terms?

- Yes, continue to the study
- No, end the study

...

Part Two: Three Screening Questions

What is your primary work country? Select the country where you work a majority of the time during an average work week.

- **United States**
- Other country

What is your work sector?

- **Business and industry (includes private and public non-profit)**
- Academia
- Government

What is your occupation group?

- Computer, information sciences or mathematical occupations (includes technicians, technologists, and managers)
- Life sciences, physical sciences or social sciences occupations (includes technicians, technologists and managers)
- **Engineering occupations (includes technicians, drafters and managers)**
- Other occupations (includes health and all other occupations)

Part Three: Five Demographic Questions

What is your gender?

Female

Male

What is your age in years? Enter 18 or greater in whole numbers.

What is your country of national origin? Select either the country where you were born or the country with which you most affiliate based on your ancestry. If the country is not listed, select other.

Albania
Argentina
Australia
Austria
Bolivia
Brazil
Canada
China
Columbia
Costa Rica

How many years have you worked in the United States? Enter 0 or greater in whole numbers.

What is your workforce category?

Individual contributor **WITHOUT** direct reports

First-level manager or supervisor **WITH** direct reports

Mid-level manager **WITH** direct reports

Executive/top-level manager **WITH** direct reports

Part Four: Leader Behaviors

Instructions

You are probably aware of people in your organization or industry who are exceptionally skilled at motivating, influencing, or enabling you, others, or groups to contribute to the success of the organization or task.

These people may be managers or non-managers. In this country, we might call such people *outstanding leaders*.

On the following pages are several behaviors and characteristics that can be used to describe leaders. Each behavior or characteristic is accompanied by a short definition to clarify its meaning.

Using the above description of outstanding leaders as a guide, rate the behaviors and characteristics on the following pages. To do this, select the scale item that best describes the degree to which you believe that characteristic or behavior either inhibits or contributes to outstanding leadership.

An example is shown below. If you believe that being tall inhibits a person from being an outstanding leader, select 1, 2 or 3, depending on the degree to which you believe being tall inhibits outstanding leadership. If you believe that being tall contributes to a person being an outstanding leader, select 5, 6 or 7, depending on the degree to which you believe being tall contributes to outstanding leadership. Finally, if you believe that being tall has no effect on whether a person is an outstanding leader, select 4.

	1. Inhibits greatly	2. Inhibits somewhat	3. Inhibits slightly	4. Has no impact	5. Contributes slightly	6. Contributes somewhat	7. Contributes greatly
Tall = Above average height	○	○	○	○	○	○	○

Questions 1-14: Rate the degree to which each behavior or characteristic either inhibits or contributes to outstanding leadership.

	1. Inhibits greatly	2. Inhibits somewhat	3. Inhibits slightly	4. Has no impact	5. Contributes slightly	6. Contributes somewhat	7. Contributes greatly
Diplomatic = Skilled at interpersonal relations, tactful	O	O	O	O	O	O	O
Evasive = Refrains from making negative comments to maintain good relationships and save face	O	O	O	O	O	O	O
Mediator = Intervenes to solve conflicts between individuals	O	O	O	O	O	O	O
Bossy = Tells subordinates what to do in a commanding way	O	O	O	O	O	O	O
Positive = Generally optimistic and confident	O	O	O	O	O	O	O

	1. Inhibits greatly	2. Inhibits somewhat	3. Inhibits slightly	4. Has no impact	5. Contributes slightly	6. Contributes somewhat	7. Contributes greatly
Intra-group competitor = Tries to exceed the performance of others in his or her group	O	O	O	O	O	O	O
Autonomous = Acts independently, does not rely on others	O	O	O	O	O	O	O
Independent = Does not rely on others; self governing	O	O	O	O	O	O	O
Ruthless = Punitive; Having no pity or compassion	O	O	O	O	O	O	O
Tender = Easily hurt or offended	O	O	O	O	O	O	O

	1. Inhibits greatly	2. Inhibits somewhat	3. Inhibits slightly	4. Has no impact	5. Contributes slightly	6. Contributes somewhat	7. Contributes greatly
Improvement-oriented = Seeks continuous performance improvement	O	O	O	O	O	O	O
Inspirational = Inspired emotions, beliefs, values, and behaviors in others, inspires others to be motivated to work hard	O	O	O	O	O	O	O
Anticipatory = Anticipates, attempts to forecast events, considers what will happen in the future	O	O	O	O	O	O	O
Risk taker = Willing to invest major resources in endeavors that do not have high probability of being successful	O	O	O	O	O	O	O

Questions 15-28: Rate the degree to which each behavior or characteristic either inhibits or contributes to outstanding leadership.

	1. Inhibits greatly	2. Inhibits somewhat	3. Inhibits slightly	4. Has no impact	5. Contributes slightly	6. Contributes somewhat	7. Contributes greatly
Sincere = Means what he/she says, earnest	○	○	○	○	○	○	○
Trustworthy = Deserves trust, can be believed and relied upon to keep his/her word	○	○	○	○	○	○	○
Worldly = Interested in temporal events, has a world outlook	○	○	○	○	○	○	○
Intra-group conflict avoider = Avoids disputes with members of his or her group	○	○	○	○	○	○	○
Administratively skilled = Able to plan, organize, coordinate and control work of large numbers (over 75) of individuals	○	○	○	○	○	○	○

	1. Inhibits greatly	2. Inhibits somewhat	3. Inhibits slightly	4. Has no impact	5. Contributes slightly	6. Contributes somewhat	7. Contributes greatly
Just = Acts according to what is right or fair	○	○	○	○	○	○	○
Win/Win problem-solver = Able to identify solutions which satisfy individuals with diverse and conflicting interests	○	○	○	○	○	○	○
Clear = Easily understood	○	○	○	○	○	○	○
Self-interested = Pursues own best interests	○	○	○	○	○	○	○
Tyrannical = Acts like a tyrant or despot; Imperious	○	○	○	○	○	○	○

	1. Inhibits greatly	2. Inhibits somewhat	3. Inhibits slightly	4. Has no impact	5. Contributes slightly	6. Contributes somewhat	7. Contributes greatly
Integrator = Integrates people or things into cohesive, working whole	○	○	○	○	○	○	○
Calm = Not easily distressed	○	○	○	○	○	○	○
Provocateur = Stimulates unrest	○	○	○	○	○	○	○
Loyal = Stays with and supports friends even when they have substantial problems or difficulties	○	○	○	○	○	○	○

Questions 29-42: Rate the degree to which each behavior or characteristic either inhibits or contributes to outstanding leadership.

	1. Inhibits greatly	2. Inhibits somewhat	3. Inhibits slightly	4. Has no impact	5. Contributes slightly	6. Contributes somewhat	7. Contributes greatly
Unique = An unusual person, has characteristics or behaviors that are different from most others	○	○	○	○	○	○	○
Collaborative = Works jointly with others	○	○	○	○	○	○	○
Encouraging = Gives courage, confidence or hope through reassuring and advising	○	○	○	○	○	○	○
Morale booster = Increases morale of subordinates by offering encouragement, praise, and/or by being confident	○	○	○	○	○	○	○
Arrogant = Presumptuous or overbearing	○	○	○	○	○	○	○

	1. Inhibits greatly	2. Inhibits somewhat	3. Inhibits slightly	4. Has no impact	5. Contributes slightly	6. Contributes somewhat	7. Contributes greatly
Orderly = Is organized and methodological in work	○	○	○	○	○	○	○
Prepared = Is ready for future events	○	○	○	○	○	○	○
Autocratic = Makes decisions in dictatorial way	○	○	○	○	○	○	○
Secretive = Tends to conceal information from others	○	○	○	○	○	○	○
Asocial = Avoids people or groups, prefers own company	○	○	○	○	○	○	○

	1. Inhibits greatly	2. Inhibits somewhat	3. Inhibits slightly	4. Has no impact	5. Contributes slightly	6. Contributes somewhat	7. Contributes greatly
Fraternal = Tends to be a good friend of subordinates	○	○	○	○	○	○	○
Generous = Willing to give time, money, resources and help to others	○	○	○	○	○	○	○
Formal = Acts in accordance with rules, convention and ceremonies	○	○	○	○	○	○	○
Modest = Does not boast, presents self in a humble manner	○	○	○	○	○	○	○

Questions 43-56: Rate the degree to which each behavior or characteristic either inhibits or contributes to outstanding leadership.

	1. Inhibits greatly	2. Inhibits somewhat	3. Inhibits slightly	4. Has no impact	5. Contributes slightly	6. Contributes somewhat	7. Contributes greatly
Intelligent = Smart, learns and understands easily	O	O	O	O	O	O	O
Decisive = Makes decisions firmly and quickly	O	O	O	O	O	O	O
Consultative = Consults with others before making plans or taking actions	O	O	O	O	O	O	O
Irritable = Moody; easily agitated	O	O	O	O	O	O	O
Loner = Works and acts separately from others	O	O	O	O	O	O	O

	1. Inhibits greatly	2. Inhibits somewhat	3. Inhibits slightly	4. Has no impact	5. Contributes slightly	6. Contributes somewhat	7. Contributes greatly
Enthusiastic = Demonstrates and imparts strong positive emotions for work	O	O	O	O	O	O	O
Risk averse = Avoids taking risks, dislikes risk	O	O	O	O	O	O	O
Vindictive = Vengeful; seeks revenge when wronged	O	O	O	O	O	O	O
Compassionate = Has empathy for others, inclined to be helpful or show mercy	O	O	O	O	O	O	O
Subdued = Suppressed, quiet, tame	O	O	O	O	O	O	O

	1. Inhibits greatly	2. Inhibits somewhat	3. Inhibits slightly	4. Has no impact	5. Contributes slightly	6. Contributes somewhat	7. Contributes greatly
Egocentric = Self-absorbed, thoughts focus mostly on one's self	O	O	O	O	O	O	O
Non-explicit = Subtle, does not communicate explicitly, communicates by metaphor, et allegory, et example	O	O	O	O	O	O	O
Distant = Aloof, stands off from others, difficult to become friends with	O	O	O	O	O	O	O
Intellectually stimulating = Encourages others to think and use their minds; challenges beliefs, stereotypes and attitudes of others	O	O	O	O	O	O	O

Questions 57-70: Rate the degree to which each behavior or characteristic either inhibits or contributes to outstanding leadership.

	1. Inhibits greatly	2. Inhibits somewhat	3. Inhibits slightly	4. Has no impact	5. Contributes slightly	6. Contributes somewhat	7. Contributes greatly
Cautious = Proceeds/performs with great care and does not take risks	O	O	O	O	O	O	O
Organized = Well organized, methodical, orderly	O	O	O	O	O	O	O
Cunning = Sly, deceitful, full of guile	O	O	O	O	O	O	O
Informed = Knowledgeable; aware of information	O	O	O	O	O	O	O
Effective bargainer = Is able negotiate effectively, able to make transactions with others on favorable terms	O	O	O	O	O	O	O

	1. Inhibits greatly	2. Inhibits somewhat	3. Inhibits slightly	4. Has no impact	5. Contributes slightly	6. Contributes somewhat	7. Contributes greatly
Egotistical = Conceited, convinced of own abilities	O	O	O	O	O	O	O
Non-cooperative = Unwilling to work jointly with others	O	O	O	O	O	O	O
Logical = Applies logic when thinking	O	O	O	O	O	O	O
Status-conscious = Aware of others' socially accepted status	O	O	O	O	O	O	O
Foresight = Anticipates possible future events	O	O	O	O	O	O	O

	1. Inhibits greatly	2. Inhibits somewhat	3. Inhibits slightly	4. Has no impact	5. Contributes slightly	6. Contributes somewhat	7. Contributes greatly
Plans ahead = Anticipates and prepares in advance	O	O	O	O	O	O	O
Normative = Behaves according to the norms of his or her group	O	O	O	O	O	O	O
Individually-oriented = Concerned with and places high value on preserving individual rather than group needs	O	O	O	O	O	O	O
Non-egalitarian = Believes that all individuals are not equal and only some should have equal rights and privileges	O	O	O	O	O	O	O

Questions 71-84: Rate the degree to which each behavior or characteristic either inhibits or contributes to outstanding leadership.

	1. Inhibits greatly	2. Inhibits somewhat	3. Inhibits slightly	4. Has no impact	5. Contributes slightly	6. Contributes somewhat	7. Contributes greatly
Intuitive = Has extra insight	O	O	O	O	O	O	O
Indirect = Does not go straight to the point, uses metaphors and examples to communicate	O	O	O	O	O	O	O
Habitual = Given to a constant, regular routine	O	O	O	O	O	O	O
Self-effacing = Presents self in a modest way	O	O	O	O	O	O	O
Able to anticipate = Able to successfully anticipate future needs	O	O	O	O	O	O	O

	1. Inhibits greatly	2. Inhibits somewhat	3. Inhibits slightly	4. Has no impact	5. Contributes slightly	6. Contributes somewhat	7. Contributes greatly
Motive arouser = Mobilizes and activates followers	O	O	O	O	O	O	O
Sensitive = Aware of slight changes in other's moods, restricts discussion to prevent embarrassment	O	O	O	O	O	O	O
Convincing = Unusually able to persuade others of his/her viewpoint	O	O	O	O	O	O	O
Communicative = Communicates with others frequently	O	O	O	O	O	O	O
Excellence oriented = Strives for excellence in performance of self and subordinates	O	O	O	O	O	O	O

	1. Inhibits greatly	2. Inhibits somewhat	3. Inhibits slightly	4. Has no impact	5. Contributes slightly	6. Contributes somewhat	7. Contributes greatly
Procedural = Follows established rules and guidelines	O	O	O	O	O	O	O
Confidence builder = Instills others with confidence by showing confidence in them	O	O	O	O	O	O	O
Group-oriented = Concerned with the welfare of the group	O	O	O	O	O	O	O
Class conscious = Is conscious of class and status boundaries and acts accordingly	O	O	O	O	O	O	O

Questions 85-98: Rate the degree to which each behavior or characteristic either inhibits or contributes to outstanding leadership.

	1. Inhibits greatly	2. Inhibits somewhat	3. Inhibits slightly	4. Has no impact	5. Contributes slightly	6. Contributes somewhat	7. Contributes greatly
Non-participative = Does not participate with others	O	O	O	O	O	O	O
Self-sacrificial = Forgoes self-interests and makes personal sacrifices in the interest of a goal or vision	O	O	O	O	O	O	O
Patient = Has and shows patience	O	O	O	O	O	O	O
Honest = Speaks and acts truthfully	O	O	O	O	O	O	O
Domineering = Inclined to dominate others	O	O	O	O	O	O	O

	1. Inhibits greatly	2. Inhibits somewhat	3. Inhibits slightly	4. Has no impact	5. Contributes slightly	6. Contributes somewhat	7. Contributes greatly
Intra-group face saver = Ensures that other group members are not embarrassed or shamed	O	O	O	O	O	O	O
Dynamic = Highly involved, energetic, enthused, motivated	O	O	O	O	O	O	O
Coordinator = Integrates and manages work of subordinates	O	O	O	O	O	O	O
Elitist = Believes that a small number of people with similar backgrounds are superior and should enjoy privileges	O	O	O	O	O	O	O
Team builder = Able to induce group members to work together	O	O	O	O	O	O	O

	1. Inhibits greatly	2. Inhibits somewhat	3. Inhibits slightly	4. Has no impact	5. Contributes slightly	6. Contributes somewhat	7. Contributes greatly
Cynical = Tends to believe the worst about people and events	O	O	O	O	O	O	O
Performance-oriented = Sets high standards of performance	O	O	O	O	O	O	O
Ambitious = Sets high goals, works hard	O	O	O	O	O	O	O
Motivational = Stimulates others to put forth efforts above and beyond the call of duty and make personal sacrifices	O	O	O	O	O	O	O

Questions 99-112: Rate the degree to which each behavior or characteristic either inhibits or contributes to outstanding leadership.

	1. Inhibits greatly	2. Inhibits somewhat	3. Inhibits slightly	4. Has no impact	5. Contributes slightly	6. Contributes somewhat	7. Contributes greatly
Micro-manager = An extremely close supervisor; one who insists on making all decisions	O	O	O	O	O	O	O
Non-delegator = Unwilling or unable to relinquish control of projects or tasks	O	O	O	O	O	O	O
Avoids negatives = Avoids saying no to another when requested to do something, even when it cannot be done	O	O	O	O	O	O	O
Visionary = Has a vision and imagination of the future	O	O	O	O	O	O	O
Willful = Strong-willed, determined, resolute, persistent	O	O	O	O	O	O	O

	1. Inhibits greatly	2. Inhibits somewhat	3. Inhibits slightly	4. Has no impact	5. Contributes slightly	6. Contributes somewhat	7. Contributes greatly
Ruler = Is in charge and does not tolerate disagreement or questioning, gives orders	O	O	O	O	O	O	O
Dishonest = Fraudulent, insincere	O	O	O	O	O	O	O
Hostile = Actively unfriendly, acts negatively towards others	O	O	O	O	O	O	O
Future-oriented = Makes plans and takes actions based on future goals	O	O	O	O	O	O	O
Good administrator = Has ability to manage complex office work and administrative systems	O	O	O	O	O	O	O

	1. Inhibits greatly	2. Inhibits somewhat	3. Inhibits slightly	4. Has no impact	5. Contributes slightly	6. Contributes somewhat	7. Contributes greatly
Dependable = Reliable	O	O	O	O	O	O	O
Dictatorial = Forces his/her values and opinions on others	O	O	O	O	O	O	O
Individualistic = Behaves in a different manner than peers	O	O	O	O	O	O	O
Ritualistic = Uses a prescribed order to carry out procedures	O	O	O	O	O	O	O

Part Five: Report of Results

Culturally endorsed implicit leadership theories (CLTs) refer to the dynamic that cultural variations result in perceptual differences toward leadership in the workplace. CLTs suggest that "leadership can be recognized based on the fit between an observed person's characteristics with an observer's implicit ideas of what leaders are" (Den Hartog et al., 1999, p. 225). Based on an individual's culture, ideals of *outstanding leadership* will vary.

Simply put, national culture is a driver of expectations toward leaders and the ideal behaviors or characteristics those leaders should possess. First, you draw conclusions who is a leader based on your CLTs. Second, you judge certain behaviors or characteristics as *good* or *bad* based on your CLTs.

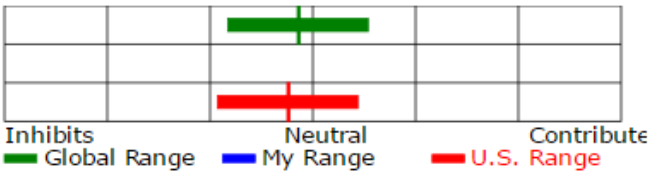
Influenced by your culture, you rated certain behaviors and characteristics as either inhibiting or contributing to outstanding leadership. The degree to which you favored certain leadership styles is depicted below. Your views are contrasted with more than 17,300 responses from from across the world and the United States.

Source: GLOBE, 2004; Chhokar, Brodbeck and House, 2007; House, Dorfman, Javidan, Hanges and Sully de Luque, 2014.

Graphs

Autonomous Style

The autonomous style is characterized by an independent, individualistic, and self-centric approach to leadership.



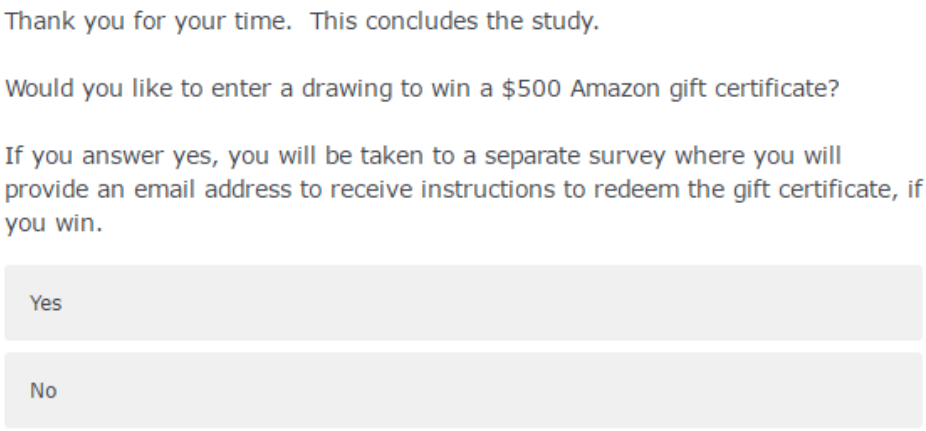


Figure Q1. Electronically reproduced GLOBE leadership scales sections 2 and 4 comprising 112 leadership scale items. Adapted from "GLOBE Project Form Beta." Copyright 2006 by The GLOBE Foundation. Adapted with permission.

APPENDIX R

Survey Two Drawing

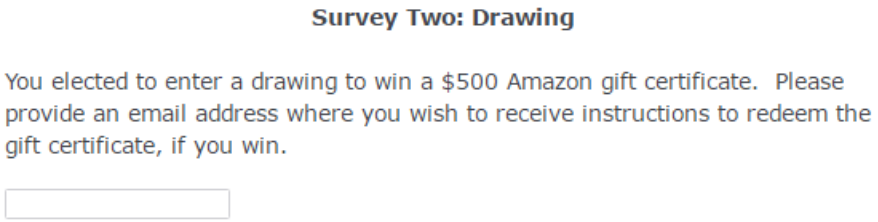


Figure R1. Electronically reproduced GLOBE leadership scales sections 2 and 4 comprising 112 leadership scale items. Adapted from Strategic Leadership across Cultures: The GLOBE Study of CEO Leadership Behavior and Effectiveness in 24 Countries, by R. J. House, P. W. Dofrman, M. Javidan, P. J. Hanges, & M. F. Sully de Luque, 2014, Los Angeles, CA: Sage Publications. Copyright 2014 by the Sage Corporation. Adapted with permission.

APPENDIX S

Survey Experience Flowchart

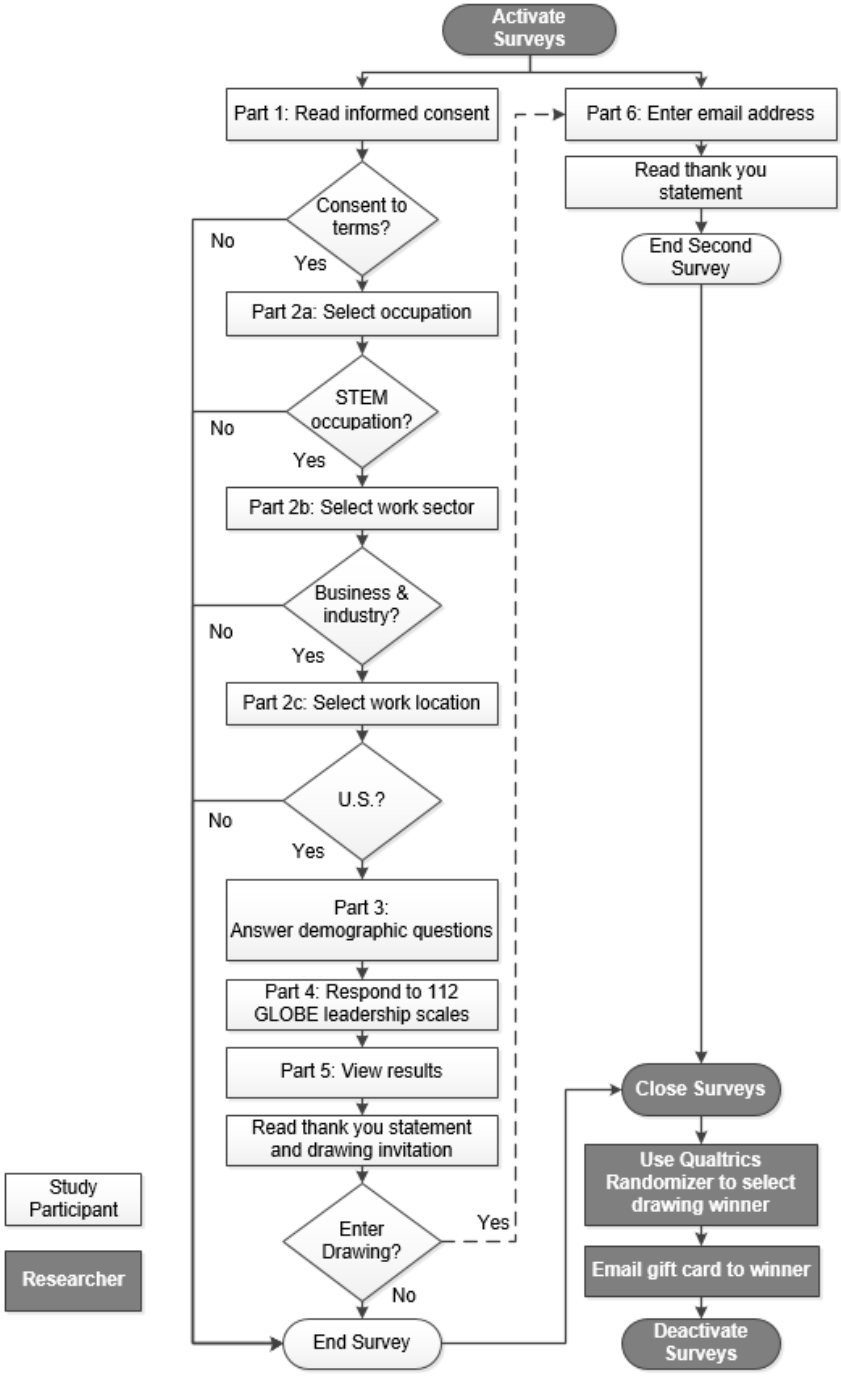
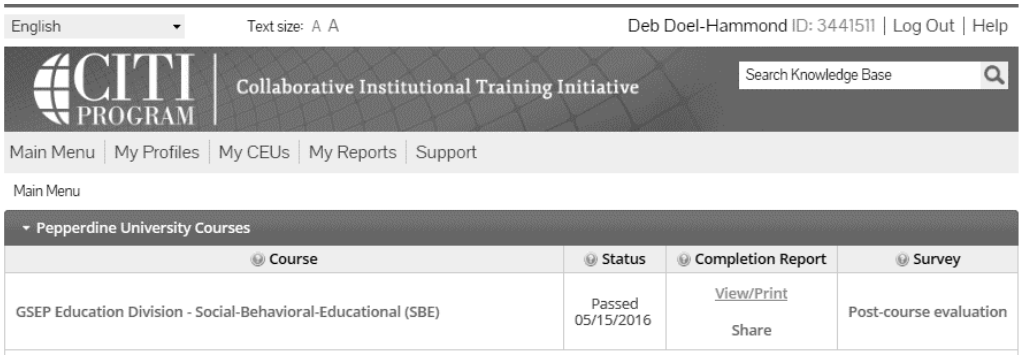


Figure S1. Survey experience flowchart depicting the six-part survey.

APPENDIX T

CITI Program Human Subjects Training Completion



English Text size: A A Deb Doel-Hammond ID: 3441511 | Log Out | Help

CITI PROGRAM | Collaborative Institutional Training Initiative

Search Knowledge Base

Main Menu | My Profiles | My CEUs | My Reports | Support

Main Menu

Pepperdine University Courses

Course	Status	Completion Report	Survey
GSEP Education Division - Social-Behavioral-Educational (SBE)	Passed 05/15/2016	View/Print Share	Post-course evaluation

APPENDIX U

Institutional Review Board Exemption Flowchart

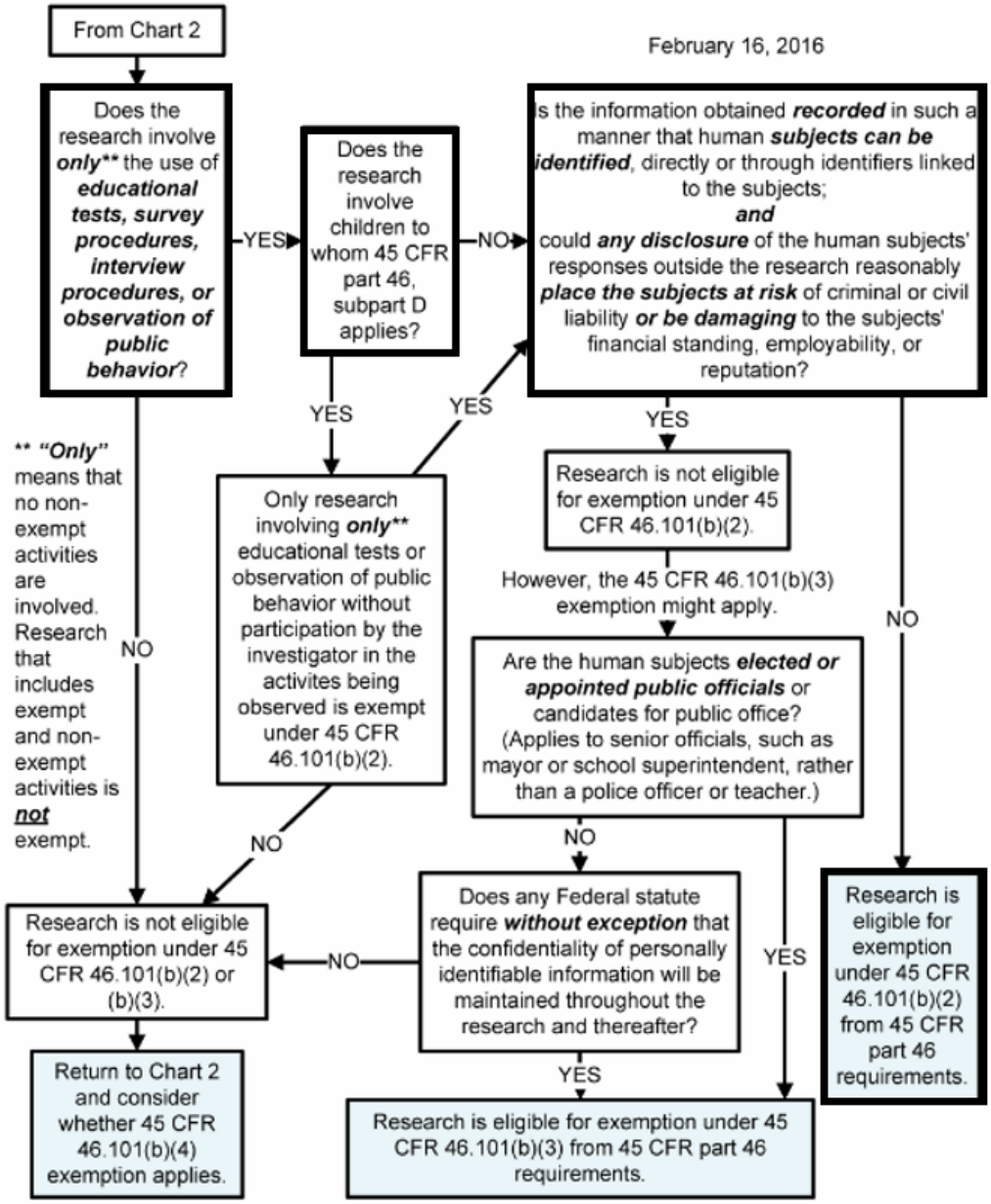


Figure U1. 45 CFR 46.101(b)(2) exemption flowchart depicting IRB exemption criteria. The bolded boxes depict this study's eligibility for exemption. Adapted from "Chart 4: Does exemption 45 CFR 46.101(b)(2) or (b)(3) for Tests, Surveys, Interviews, Public Behavior Observation) Apply?" U.S. Department of Health and Human Services, Office for Human Research Protections, 2016, February 16. No copyright per Title 17 U.S.C., Section 105.

APPENDIX V

IRB Exception Notification

PEPPERDINE

Pepperdine University
24255 Pacific Coast Highway
Malibu, CA 90263
TEL: 310-506-4000

NOTICE OF APPROVAL FOR HUMAN RESEARCH

Date: December 22, 2016

Protocol Investigator Name: Deb Doel-Hammond

Protocol #: 16-05-279

Project Title: U.S. STEM Workforce Views of Outstanding Leadership: A Correlational Study

School: Graduate School of Education and Psychology

Dear Deb Doel-Hammond:

Thank you for submitting your application for exempt review to Pepperdine University's Institutional Review Board (IRB). We appreciate the work you have done on your proposal. The IRB has reviewed your submitted IRB application and all ancillary materials. Upon review, the IRB has determined that the above entitled project meets the requirements for exemption under the federal regulations 45 CFR 46.101 that govern the protections of human subjects.

Your research must be conducted according to the proposal that was submitted to the IRB. If changes to the approved protocol occur, a revised protocol must be reviewed and approved by the IRB before implementation. For any proposed changes in your research protocol, please submit an amendment to the IRB. Since your study falls under exemption, there is no requirement for continuing IRB review of your project. Please be aware that changes to your protocol may prevent the research from qualifying for exemption from 45 CFR 46.101 and require submission of a new IRB application or other materials to the IRB.

A goal of the IRB is to prevent negative occurrences during any research study. However, despite the best intent, unforeseen circumstances or events may arise during the research. If an unexpected situation or adverse event happens during your investigation, please notify the IRB as soon as possible. We will ask for a complete written explanation of the event and your written response. Other actions also may be required depending on the nature of the event. Details regarding the timeframe in which adverse events must be reported to the IRB and documenting the adverse event can be found in the *Pepperdine University Protection of Human Participants in Research: Policies and Procedures Manual* at community.pepperdine.edu/irb.

Please refer to the protocol number denoted above in all communication or correspondence related to your application and this approval. Should you have additional questions or require clarification of the contents of this letter, please contact the IRB Office. On behalf of the IRB, I wish you success in this scholarly pursuit.

Sincerely,

Judy Ho, Ph.D., IRB Chair

Figure V1. Pepperdine IRB Exemption Notice

APPENDIX W

U.S. STEM Workforce Contrasted with GLOBE

Table T1

Comparison of GLOBE Universally Positive Attributes and U.S. STEM

Attribute	Universally Endorsed	U.S. STEM Workforce (n = 151)		GLOBE Senior Managers (n = >17,300)	
		M	*SD*	*M*	*SD*
Trustworthy	Contributes	6.81	0.55	6.36	0.39
Clear		6.65	0.61		
Sincere		6.62	0.72		
Inspirational		6.60	0.74		
Diplomatic		6.60	0.80		
Motive arouser	Contributes	6.58	0.65	6.07	0.51
Excellence-oriented	Contributes	6.55	0.72	6.16	0.42
Honest	Contributes	6.54	0.72	6.11	0.45
Team-builder	Contributes	6.52	0.84	6.15	0.39
Dependable	Contributes	6.50	0.72	6.17	0.36
Motivational	Contributes	6.48	0.86	6.00	0.39
Confidence-builder	Contributes	6.46	0.74	6.14	0.34
Visionary		6.44	0.81		
Encouraging	Contributes	6.44	0.77	6.14	0.29
Communicative	Contributes	6.44	0.65	6.02	0.48
Intelligent	Contributes	6.44	0.60	6.18	0.38
Positive	Contributes	6.42	0.96	6.04	0.45
Morale booster		6.42	0.83		
Collaborative		6.39	0.64		
Dynamic	Contributes	6.37	0.84	6.28	0.34
Intellectually stimulating		6.35	0.76		
Anticipatory		6.35	0.84		
Informed	Contributes	6.34	0.86	6.13	0.41
Improvement-oriented		6.33	0.81		
Win/win problem-solver	Contributes	6.33	0.83	6.06	0.36
Integrator		6.31	0.79		
Enthusiastic		6.30	0.84		
Plans ahead		6.30	0.76	6.17	0.37
Able to anticipate		6.25	0.68		
Intuitive		6.25	0.84		

(continued)

Attribute	Universally Endorsed	U.S. STEM Workforce (n = 151)		GLOBE Senior Managers (n = >17,300)	
		M	*SD*	*M*	*SD*
Prepared		6.24	0.75		
Just		6.24	0.98	6.02	0.37
Calm		6.21	0.89		
Effective bargainer	Contributes	6.19	0.88	6.10	0.39
Foresight	Contributes	6.19	0.72	6.02	0.33
Ambitious		6.17	0.99		
Future-oriented		6.17	0.77		
Group-oriented		6.11	0.86		
Consultative		6.09	0.82		
Convincing		6.06	0.95		
Performance-oriented		6.06	1.06		
Logical		6.05	0.81		
Decisive	Contributes	6.03	0.98	6.21	0.33
Mediator		5.97	0.92		
Patient		5.94	1.01		
Administratively skilled	Contributes	5.80	0.99	6.00	0.50
Organized		5.79	0.98		
Compassionate		5.75	1.04		
Willful		5.73	1.22		
Orderly		5.72	0.81		
Good administrator		5.62	0.98		
Coordinator	Contributes	5.61	1.08	6.00	0.40
Modest		5.50	1.12		
Generous		5.48	1.09		
Worldly		5.40	1.10		
Self-sacrificial		5.34	1.44		
Intra-group face-saver		5.32	1.20		
Risk taker		5.26	1.30		
Loyal		5.25	1.48		
Sensitive		5.25	1.08		
Self-effacing		5.03	1.23		

Note. Views of the U.S. STEM workforce in the business and industry sectors support GLOBE's universally endorsed leader attributes contributing to outstanding leadership. Means scores greater Adapted from Strategic Leadership across Cultures: The GLOBE Study of CEO Leadership Behavior and Effectiveness in 24 Countries, by R. J. House, P. W. Dofrman, M. Javidan, P. J. Hanges, & M. F. Sully de Luque, 2014, Los Angeles, CA: Sage Publications.

APPENDIX X

Palgrave Macmillan Permissions

Palgrave Macmillan LICENSE TERMS AND CONDITIONS

Nov 08, 2015

License Number	3744430547956
License date	Nov 08, 2015
Licensed content publisher	Palgrave Macmillan
Licensed content publication	Journal of International Business Studies
Licensed content title	Mapping world cultures: Cluster formation, sources and implications
Licensed copyright line	Copyright © 2013, Macmillan Publishers Ltd.
Licensed content author	Simcha Ronen, Oded Shenkar
Licensed content date	Aug 29, 2013
Type of Use	Thesis/Dissertation
Requestor type	Student
The intended publisher of new work	n/a
Format	Print, Electronic
Portion	chart/graph/table/figure
Number of charts/graphs/tables/figures	2
Rights for	Main product and other compilations/derivative products
Duration of use	Life of current edition
Creation of copies for the disabled	no
With minor editing privileges	yes
For distribution to	Worldwide
In the following language(s)	Original language of publication
With incidental promotional use	no
The lifetime unit quantity of new product	0 to 499
Specified additional information	I am requesting permission to use 1) the final pie of clusters, Figure 4; and 2) to list the countries in a column, to compare with the GLOBE study county clusters. Regarding worldwide distribution, I selected this option because most dissertations are published in an electronic database. Clarification on this requirement is requested. Thank you.
The requesting person/organization is:	Deb Doel-Hammond, Pepperdine University
Order reference number	1
Title of your thesis / dissertation	U.S. STEM Workforce Views of Outstanding Leadership: A Correlational Study
Expected completion date	May 2016
Expected size (number of	150

APPENDIX Y

Sage Permissions

Job Ticket Details

Job ticket ID	501076052	Order date	Nov 8, 2015
Job ticket type	Permission Order	Queue name	Permission Orders - Denied/Canceled/Expired
Job ticket status	Order Canceled		
Type of use	Thesis/Dissertation		
Requestor type	Author of requested content		
Format	Electronic		
Portion	chart/graph/table/figure		
Number of charts/graphs/tables/figures	4		
Title or numeric reference of the portion(s)	Figure 1.1 Globe Theoretical Model; Figure 1.2 All Countries in GLOBE; Figure 1.3 Global and Primary Culturally Endorsed Implicit Leadership Theory Dimensions, etc.; and 1.4 Societal Ratings for Universal, etc.		
Title of the article or chapter the portion is from	All chapter one.		
Editor of portion(s)	N/A		
Author of portion(s)	N/A		
Volume of serial or monograph	N/A		
Issue, if republishing an article from a serial	N/A		
Page range of portion	6-25		
Publication date of portion	2004-2014		
Rights for	Main product and any product related to main product		
Duration of use	Life of current edition		
Creation of copies for the disabled	no		
With minor editing privileges	yes		
For distribution to	Worldwide		
In the following language(s)	Original language of publication		
With incidental promotional use	no		
Lifetime unit quantity of new product	Up to 499		
Made available in the following markets	None. Only the Proquest Database of Theses and Dissertations.		
Specified additional information	I am requesting use of the four figures and additionally the ability to list the countries from Figure 1.2 in a column, to to compare the GLOBE country clusters with clusters created by other researchers.		
The requesting person/organization	Deb Doel-Hammond/Pepperdine University		
Order reference number	1		
Author/Editor	Deb Doel-Hammond		
The standard identifier	Doel-Hammond Dissertation		
Title	U.S. STEM Workforce Views of Outstanding Leadership: A Correlational Study		
Publisher	Author (typically published on Proquest)		
Expected publication date	May 2016		
Estimated size (pages)	150		
Total	Not Available		
Last Comment	Michelle Binur:		Nov 13, 2015 6:25:18 PM
Previous Comments	You may use the material in your thesis/dissertation as long as you properly credit the original sources. Permission does not cover 3rd party material. You do not need a license/agreement to reuse material for a thesis/dissertation, but if you are planning to republish the material in a publication (i.e. book, journal article, etc...), then you would need to obtain further permission.		
Special Terms	None		

APPENDIX Z

Yeganeh Permissions

Yeganeh, Hamid via pepperdine.edu 3:50 PM (1 hour ago)
to me

Dear Deb Doel-Hammond
You are very welcome. You have my permission to use, replicate, and publish my work on culture in your dissertation and papers.

Sincerely

Hamid Yeganeh, PhD
Associate Professor of International Management
[Redacted]

From: Deb Doel-Hammond **[Redacted]**
Sent: Sunday, November 08, 2015 5:42 PM
To: Yeganeh, Hamid
Subject: CCI permission request for dissertation

Dr. Yeganeh,

My name is Deb Doel-Hammond. I'm a doctoral student at Pepperdine University. I am writing a dissertation on U.S. Science, Technology, Engineering and Mathematics (STEM) perceptions of leadership. I have used your CCI to inform my study that will apply the GLOBE leadership scales in U.S. STEM. The purpose email is to request your permission to publish content from your CCI in my dissertation. Emerald advises on their website that if copyright.com<http://copyright.com> does not present the title of your article, I should contact you directly. The CCI content would be presented as follows. There would be additional references to your work in my literature review and also the study limitation:

[Inline image 1]

Please let me know if I may answer additional questions. Thank you for your consideration.

Sincerely,

Deb Doel-Hammond
[Redacted]